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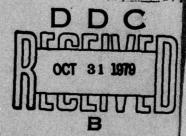# EVALUATION OF EFFECTS OF PANAMA CANAL DEEPENING UPON THE STABILITY OF LA PITA HILL

by

Wendell O. Miller

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September 1979
Final Report

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents an analysis and evaluation of the stability, as well as provides design recommendations for La Pita Hill on the Panama Canal. The site was selected for study by the Panama Canal Company (PCC) based upon scheduled Canal deepening locations and stability of adjacent slopes. This report provides systematic, step-by-step guidance for preventing a massive failure of La Pita Hill caused by Canal deepening operations, i.e. blasting and

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20. ABSTRACT (Continued)

excavation. The results are not intended for direct extrapolation either to other sites along the Canal or to small localized failures along the slopes adjacent to La Pita Hill.

This report provides the basis for the future evaluation of slopes affected by Canal deepening but is not intended to set a precedence for the method of analysis. Any future study should be independent but should draw upon the experience gained from preceding analyses.

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PREFACE

This study was initiated by a request from the Panama Canal Company (PCC) that the U. S. Army Engineer Waterways Experiment Station (WES) prepare a work statement describing a study approach for selected slopes in the Gaillard Cut. A work statement was prepared by WES and transmitted to PCC on 1 October 1974. La Pita Hill was chosen for analysis, and authorization for the study was obtained in a letter from PCC dated 8 November 1974.

Upon completion of this study, a draft of the report was transmitted to PCC for review and comments. Since transmittal of the draft, WES and PCC have held numerous discussions. As a result of the review and discussions, several of the recommendations in this report were implemented prior to publication.

The study was conducted and this report was prepared by Mr. W. O. Miller, Rock Mechanics Applications Group (RMAG), Engineering Geology and Rock Mechanics Division (EGRMD), Geotechnical Laboratory (GL), WES. Technical assistance was provided by Mr. R. D. Bennett, RMAG; Mr. J. L. Gatz, Chief, Exploration Group, EGRMD; and Mr. G. P. Hale, Chief, Soil Testing Facility, Soil Mechanics Division (SMD), GL. The study was conducted under the direct supervision of Mr. J. S. Huie, Chief, RMAG, and Dr. D. C. Banks, Chief, EGRMD, and under the general supervision of Messrs. J. P. Sale and R. G. Ahlvin, Chief and Assistant Chief, respectively, GL. The report was reviewed by Dr. F. G. McLean, former Chief, Earthquake Engineering and Geophysics Division, GL; Dr. R. J. Lutton, Research Group, EGRMD; and Messrs. S. J. Johnson, former Special Assistant, GL; and C. L. McAnear, Chief, SMD. The study was closely coordinated with PCC personnel, particularly Mr. A. P. Mann, Chief, Civil Engineering Branch, Engineering Division, and several of his associates: Messrs. R. H. Stewart and F. A. Len-Ríos, CPT J. McCutchan, and Mrs. J. Stewart.

Directors of WES during the conduct of the study and the preparation of this report were COL G. H. Hilt, CE, COL J. L. Cannon, CE, and COL N. P. Conover, CE. Technical Director was Mr. F. R. Brown.

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CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
feet	0.3048	metres
inches	25.4	millimetres
inches per minute	25.4	millimetres per minute
inches per second	25.4	millimetres per second
pounds (force)	4.448222	newtons
pounds (force) per square foot	47.88026	pascals
pounds (mass)	0.4535924	kilograms
pounds (mass) per cubic foot	16.01846	kilograms per cubic metre
tons (force) per square foot	95.76052	kilopascals

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EVALUATION OF EFFECTS OF PANAMA CANAL DEEPENING
UPON THE STABILITY OF LA PITA HILL

PART I: INTRODUCTION

Background

1. The Bank Stability Surveillance Program (BSSP) of the Panama
Canal Company (PCC) has provided data in the past several years that
indicate varying degrees of stability for portions of the banks of the
Panama Canal in the area of the Gaillard Cut. The BSSP data collection
has been supplemented by a long-term study of the clay shale slopes
during which as complete a record as possible was compiled of historical,
geological, and engineering data starting from the early days of Panama
Canal construction and continuing into the early to mid-1970's (Lutton
and Banks, 1970; Lutton, 1975; Banks et al., 1975; Banks, 1978; and
Banks, Strohm, and Lutton, in preparation). These references emphasize
the continued need for concern over slope stability, especially during
planning and construction of the 9-ft* deepening of the Canal.

2. It is hoped that the Canal can be deepened in the vicinity of
both stable and marginally stable slopes in such a manner that slope
failures will be prevented. At the same time, it is recognized that,
since the deepening will affect the toe of the slopes, even the rela-
tively minor new excavation may have a serious effect on slope stability.
Additionally, since deepening by underwater blasting techniques is
planned, the forces applied to the slopes by blasting and/or the change
in material properties caused by the blasting may be sufficient to cause
damage or even failure. These possible causes for concern led PCC to
request a statement from the U. S. Army Engineer Waterways Experiment
Station (WES) describing a study approach for assessing the stability of
specific slopes selected by PCC and design recommendations to prevent

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* A table of factors for converting U. S. customary units of measure-
ment to metric (SI) units is found on page 4.

failure*. The study approach is illustrated in Figure 1. Upon review of the work statement, PCC selected La Pita Hill as the first area for study and authorized WES to proceed on a study of that slope.**

General Description of Study Area

3. La Pita Hill lies on the east bank of the Cunette Reach of the Panama Canal approximately between sta 1827 and sta 1837 where La Pita Ridge intersects the Canal cut.[†] The hill and ridge form the topographic high in the immediate area, as shown in Figure 2, rising approximately 310 ft above the present Canal bottom. Cross sections through La Pita Hill show the front slope to rise roughly 110 to 130 ft above the Canal bottom on approximately a 1.75V on 1H slope (60 deg) and then on approximately a 1V on 2.75H slope (20 deg) for the remaining 180 to 200 ft.

4. The hill has experienced a limited amount of instability in the past with at least one slide occurring on the hill and several others in the immediate vicinity (Figure 2). A description of the history, geology, and mechanics of movements in the area have been reported by Lutton (1975). The slides in this area began during the early construction and continued intermittently over a period of many years; no recent activity has been noted.

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* Work Statement for PCC by WES, "Incremental Slope Designs and Development of Blasting Criteria Related to the Deepening of the Panama Canal," transmitted by letter dated 1 Oct 1974.

** Letter from Mr. R. J. Risberg, Chief, Engineering Division, PCC, Subject: Analysis and Recommendation for Stabilization of La Pita Hill, dated 8 Nov 1974.

† In this report, present (1975) Canal stationing is used. The Cunette Reach lies between the Cunette and the Empire points of intersection (PI). These points are located as follows:

PI	Station	Latitude	Longitude
Cunette	1819+57.2	9° 04' + 1119.7	79° 40' + 2788.5
Empire	1842+57.4	9° 03' + 5711.7	79° 40' + 1494.1

Azimuth of Canal center line in Cunette Reach: 321° 05' 43".

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5. The planned deepening of the Canal in the vicinity of La Pita Hill caused concern over the present stability of the hill. This interest was generated by several important considerations: (a) previous slide activity in the area, (b) the large potential mass that could be involved in a massive failure, and (c) method of excavation, i.e., blasting along the toe of the hill with subsequent removal of resisting material from the toe of the slope.

Purpose

6. The purpose of this study is to provide an assessment of La Pita Hill as it presently exists and to evaluate the possibility of a major failure of the hill which could result from the proposed deepening operations in the area. In addition, if the assessment should indicate the possibility of a major failure, procedures or techniques are to be recommended for either increasing the factor of safety or controlling the amount by which it is reduced.

Scope

7. Acquisition of data for the analyses included a review of historical records, review of information gathered under the BSSP and other data of PCC and WES, taking samples in new borings, and laboratory testing to identify strength and index properties of materials encountered. The need for additional borings to identify the geologic structure more completely and for laboratory tests to determine strength parameters immediately became evident following a review of existing data from the study area.

8. Laboratory strength tests were conducted at WES on the new samples to determine the current strength parameters and compare them with peak and residual values. Because of a restricted time frame and limited funds, only those samples deemed most important to the study were tested.

9. During 1975 the Canal was deepened by blasting on the opposite bank of the Cunette Reach in the near vicinity of La Pita Hill as shown in Figure 3. Seismographic records were obtained to assist in the development of acceleration criteria for use in the analyses. In addition to the evaluation of present seismographic records, all blast records previously acquired were reviewed, and appropriate relationships of velocity versus scaled distance and acceleration versus scaled distance were developed.

10. Stability analyses of La Pita Hill were made following two different procedures. First, a semiempirical two-dimensional effective stress analysis was made to obtain an estimate of the long-term stability of the hill after deepening. Following guidance recommended by Banks et al. (1975), a failure plane was assumed and strengths were determined from back analyses of failures that had occurred within the same geologic formation (Las Cascadas). Second, to obtain an evaluation of the short-term stability of the hill, a conventional two-dimensional total stress analysis was performed using laboratory strengths partitioned along trial failure surfaces. As will be explained later, the choice of a two-dimensional analysis rather than a three-dimensional analysis was governed by an evaluation of all subsurface information currently available on the site. For the short-term analysis, the stability of La Pita Hill was determined for (a) its present conditions, (b) its condition after removal of the toe, and (c) its condition after removal of the toe with additional forces caused by average blast-induced accelerations acting uniformly upon the slope. An additional analysis was conducted using distributed accelerations imposed upon the slope.

11. Recommendations proposed in this report have been made concerning existing and future stability of the La Pita Hill and economically feasible ways for maintaining the stability against a massive failure. These recommendations should be limited to La Pita Hill per se and are not intended for extrapolation to other areas along the Canal.

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PART II: GEOLOGY AND FIELD DATA

General Geology

12. La Pita Hill is composed of materials of the Las Cascadas formation, described by Woodring (1957) as being volcanic in origin and consisting principally of agglomerate and tuff. The matrix of the agglomerate consists of soft, fine-grained altered tuff and bentonitic clay. Lutton (1975) stated that the formation has been generally regarded as Oligocene (but without verification) and thought to contain four rock types: dacitic tuff breccia (also called agglomerate), tuff, welded tuff (also called ignimbrite and ash flow), and andesite. The tuff breccia, welded tuff, and andesite, while jointed, are generally stronger than the tuff. The tuff layers are generally thin (on the order of 10 ft) and soft, and at the location of previous slides, functioned as parts of the sliding surfaces. Slickensides appear to be a characteristic feature of the tuff. Geologic information determined from a review of both past and present boring logs generally confirms these descriptions. A description of the general geology at La Pita Hill has been presented by Lutton (1975).

Specific Geology

13. Strata in the hill consist of a sequence of interbedded andesites, tuffs, agglomerates, and ash flows, all dipping generally toward the Canal. Saprolitic overburden, derived from andesite, ranges in depth from zero near the Canal excavation down to a maximum of approximately 100 ft on the crest of the hill.

14. Table 1 lists the borings from which subsurface information was available for this study. Boring logs indicated the presence of numerous faults, joints, shear zones, and highly faulted areas. The approximate general locations of both confirmed and possible faults have

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been indicated in Figure 3. Boring logs available at the beginning of the study indicated the possible existence of a fault paralleling the Canal that could serve as a back scarp for a potential slide mass. (The possible fault is labeled C-C in Figure 3.) The possible fault was located between borings SC-82 and ERE-18 and was indicated by the general lack of correlation of strata encountered in these two borings. Since the possible fault was located at a particularly critical location and since the geologic picture was still incomplete for a specific analysis, three additional borings were drilled by WES crews and a shallow trench was excavated by PCC crews at the La Pita Hill site.

15. The locations of the three new borings, ERE-25, ERE-26, and ERE-27, are shown in plan in Figure 3. The three new borings were located to intercept the possible fault, and to determine if it dipped toward the Canal and could thus function as the back scarp of a possible sliding mass. Boring ERE-25 was made using a 4- by 5-1/2-in. standard Diamond Core Drill Manufacturers Association (DCDMA) double-tube, swivel-head core barrel with cemented carbide insert bits. After boring ERE-25 was logged and the core evaluated, an offset boring ERE-25A was made using a 5- by 6-1/4-in. modified Denison sampler with cemented carbide insert bits to obtain undisturbed cores. Borings ERE-26 and ERE-27 were made using a 4- by 5-1/2-in. standard DCDMA double-tube, swivel-head core barrel with cemented carbide insert bits. Logs of the borings were compiled by PCC geologists and are included in Appendix A for complete-ness. An evaluation of the core samples and logs of the three borings did not conclusively confirm or deny the existence of any of the faults within the hill (Figure 3) although the borings did reveal numerous zones of sheared or faulted materials and provided additional geologic information about La Pita Hill. A review of all boring logs in the hill indicated a general predominance of broken or sheared zones within the weaker strata, i.e., tuffs and agglomerates. In general, the hill appears to consist of fairly competent materials (andesites and ash flows) with zones of weaker, broken, and sheared materials (tuffs and agglomerates).

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16. An open-face trench (benched excavation), approximately 40 ft deep, 100 ft wide, and 200 ft long, was excavated along the side of the steep slope on the northwest side of La Pita Hill with bulldozers by PCC crews. The trench (Figure 3) was located to provide additional information concerning the existence of the possible fault. The trench was inspected by PCC geologists, who were able to determine only minor possible expressions of a fault within the overburden materials. No conclusive evidence was determined to confirm the fault.

17. Geologic cross sections (Figures 4 and 5), prepared through sta 1831+00 perpendicular to the Canal center line and sta 1835+50 skewed to the north at an angle of 67.5 deg with the Canal center line (labeled A-A and B-B, respectively, in Figure 3), show the materials to be bedded and generally continuous, with a strike of S 61° E and a dip of approximately 5° SW. The oblique section through sta 1835+50 (Figure 5) is drawn parallel to the dip of bedding.

Simplification of Geology

18. The complexities of lithological types, stratigraphy, faults, shear zones, and joints indicated in Figures 3, 4, and 5 caused difficulties in understanding the possible failure mechanics of La Pita Hill. For a stability analysis of La Pita Hill, an in-depth evaluation was required of all available data from the site.

19. An evaluation of the entire geologic picture of the La Pita Hill area revealed layered materials which, in general, possessed numerous sheared and broken zones. In some cases these zones have been termed faults to explain discontinuity of strata between borings. However, the majority of the faults within the hill are inferred faults that exhibit only minor throws and are oriented to form only a minor portion of a potential slide mass. Two faults which were inferred as major faults in the study area were evaluated both separately and jointly. One fault (designated D-D in Figure 3) strikes N 40° E and dips approximately 74° SE, passing through boring ERE-9; and the other (designated E-E in

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Figure 3) strikes N 10° E and dips 60° NW, passing through boring ERE-2 (Figure 3). These two faults form a wedge-shaped prismoid which isolates the central portion of the hill from either side. The dips of these two faults are such that they extend outward and downward away from the hill and thus are not considered to contribute major or significant sliding planes for the purposes of an analysis. This observation suggests that the stability behavior of the central portion of La Pita Hill can be assessed using a two-dimensional analysis rather than a three-dimensional analysis.

20. In order to perform a two-dimensional stability analysis of La Pita Hill, the following generalizations and assumptions were necessary:

a. Materials similar in strength properties and somewhat similar in composition and method of deposition, i.e., tuffs, agglomerates, agglomeratic tuffs, and tuffaceous agglomerates, were grouped together as tuff breccia in order to describe certain layers within the hill.

b. Ash flows and agglomerates, which were described as ignimbrites on PCC boring logs, were grouped together as a layer of "ignimbrite" and subsequently served as a "marker" bed in describing and evaluating the geologic structure of the study area.

c. Strata within the hill were assumed to be continuous, and discrepancies between elevations of materials in boring logs and those plotted on the analysis cross section were primarily accounted for by the offset of the borings from the section analyzed.

d. Major faults within the hill are oriented and dipping in such a manner that it was assumed that a three-dimensional wedge-type failure was highly improbable.

e. The section chosen for analysis (Section A-A, assumed most critical) was perpendicular to the Canal through sta 1831+00 (Figure 4), which represented the steepest ground surface profile, rather than the section skewed at 67.5 deg with the Canal (Section B-B) through sta 1835+50 (Figure 5), which represented the steepest bedding dip for the study area.

21. These assumptions, necessary to perform an analysis, are generally consistent with the overall geologic interpretation of the hill from an engineering standpoint, i.e., assumptions made do not compromise the strength parameters governing the stability of the hill. The simplified profile is shown in Figure 6.

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Groundwater and Pore Pressure Conditions

BSSP data

22. Groundwater level measurements, obtained in open boreholes by the BSSP, were furnished by PCC at the beginning of the study for 10 boreholes in the immediate area of La Pita Hill. The designation and location of these boreholes are listed in Table 1.

23. The maximum and minimum levels recorded were chosen as limiting conditions for use in stability analyses. These maximum and minimum levels are shown in a section in Figure 7. To establish the section, boreholes with their appropriate water levels were projected parallel to the center line of the Canal. The ground surface profile depicted in Figure 7 represents the ground surface at each of the individual boreholes.

24. Groundwater levels and pore pressures are applicable to effective stress analysis rather than to total stress analysis. As will be discussed later, only the semiempirical analysis used effective strengths.

Recent data

25. To supplement the existing data and more precisely identify pore pressures active within the analysis area, two piezometers were placed in La Pita Hill during the recent boring program. These piezometers were placed in borings ERE-25A and ERE-27. In addition, borings ERE-25 and ERE-26 were used for open-hole water level measurements.

26. Water levels within borings ERE-25 and ERE-26 were generally consistent with the previously defined groundwater conditions plotted in Figure 7. The piezometer levels reflected in borings ERE-25A and ERE-27, however, were substantially lower than readings recorded in the open boreholes, thus indicating that a perched water table was measured in the open boreholes. The geologic information available for the hill tends to support the likelihood of a perched water table. The boring logs and interpreted geologic cross sections reveal numerous strata beneath the overburden materials that are highly broken and sheared,

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thus indicating high permeabilities and the probability of somewhat free draining layers at depth.

27. The use of water levels recorded in the open boreholes, i.e. the perched water table, for defining pore pressures rather than the lower pore pressures indicated by the piezometers provides conservative assumptions with respect to the anticipated pore pressures at depth. Pore pressures associated with the upper water levels were used in the semiempirical analysis of the slope (effective stress analysis) and thus caused a more conservative (lower) factor of safety to be calculated.

Surface and Subsurface Motion Vectors

BSSP data

28. The potential of a slide at La Pita Hill, as reflected by previous activity in the area, resulted in the establishment of BSSP surface monuments and electronic distance measurement (EDM) stations in 1972 to measure both surface movement and settlement (Tables 1 and 2). In addition, one Telemac and eight plain-cased deflection boreholes were used to monitor any subsurface movement or activity (Table 1).

29. The readings furnished by PCC from each of these data sources were plotted to determine a movement history as well as total resultant vector movement. The alignment checks, made on 15 surface monuments for the purpose of detecting horizontal movement of the slope toward the Canal, have been plotted in Figure 8. Except for the one apparently erroneous or at least questionable reading (1.44 ft), the maximum recorded movement toward the Canal was 0.17 ft or approximately 2 in. A study of the movement history indicates initial movements toward the Canal with subsequent movements away from the Canal or upslope. This behavior suggests the possibility of surveying inaccuracies, especially in view of the relatively small magnitude of movements being recorded.

30. Settlement readings for the slope were made for the surface monuments mentioned previously. The total settlement and the settlement

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history are plotted in Figure 9. With the exception of two readings (0.54 and 0.49 ft), the maximum recorded settlement for the 15 measurement points was 0.07 ft or approximately 0.8 in. A study of the history of the measurements indicates initial settlement with subsequent rebound, again suggesting possible surveying inaccuracies.

31. EDM's have been made from a station on the opposite bank of the Canal to six selected EDM points located on La Pita Hill. The total movement and the movement history of the measurement points are plotted in Figure 10. The maximum resultant vector movement to date has been 0.008 m or approximately 0.32 in., reported for surface monument No. 2 and for boring ERE-3. It should be noted that the alignment checks (Figure 8) reported a movement of monument No. 2 of 0.12 ft or approximately 1.4 in. A study of the EDM movement history does not reveal any trends suggesting inaccuracies. The movements reported were, however, very small and not considered to be of any significance due to their apparently random directional orientation.

32. Data furnished for the plain-cased deflection boreholes and the Telemac showed no subsurface movement or blockage.

33. The recent history of the hill, as reflected by the BSSP data collected to date, indicates that the slope is presently stable for existing conditions.

Recent data

34. During the drilling of boring ERE-25 for this study, an offset in the boring was reported at a depth of approximately 86 ft (el 253,* slightly above the overburden-andesite contact) immediately after a blast on the opposite bank of the Canal. The Survey Branch of PCC obtained readings for all plain-cased deflection boreholes at La Pita Hill to determine if the hill was involved in motion. The Survey Branch reported no movement in any of the other holes, thus suggesting the probability of hole collapse or only localized movement at boring ERE-25.

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* All elevations (el) cited herein are in feet referred to mean sea level.

35.   While the recent data indicate a stable slope for existing conditions, PVC pipes were placed in borings ERE-25 and ERE-26 to serve as plain-cased deflection boreholes to provide measurement points in addition to those previously established at La Pita Hill.

PART III: BLASTING DATA

General Blast Records

36. A large volume of blast data (i.e. ground acceleration and velocity measurements for known charge weights being detonated at known locations) has been collected during production blasting along the Canal, particularly for the Canal widening project in the 1960's. In addition, a smaller number of records of ground motion resulting from special calibration and quarry blasts were also available at the beginning of this study. Two velocity seismographs (Sprengnether, Model No. VS-1100) placed on La Pita Hill during the recent (1975) Canal deepening operations on the opposite bank of the Cunette Reach supplemented these previous records and provided specific information concerning the response of the hill to dynamic loadings. The instruments were placed at sta 1831+50, at offsets of 500 and 900 ft east of the Canal center line (Figure 3). For seven blasts, however, the instrument offset 900 ft was moved to sta 1838+14.7 at an offset of 642 ft west of the Canal center line to monitor accelerations being imposed by the blasting upon a concrete spillway located on the west bank of the Canal.

37. The blasting data were compiled, with PCC assistance, to determine (a) general relationships between ground motion response, in terms of acceleration and velocity, and scaled distance (range R divided by the cube root of the charge weight W, i.e. $R/W^{1/3}$); (b) the agreement between general data and those specifically collected at La Pita Hill; (c) the maximum level of ground motion (particle velocity and acceleration) to which La Pita Hill had been subjected in the past; and (d) a particle acceleration profile for La Pita Hill.

Data Reduction

38. All blast records provided to WES were systematically reduced and the results plotted to obtain appropriate relationships for velocities and accelerations versus scaled distance. The method of reducing

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seismographic data currently used by PCC (and adopted by WES for this study) is a very conservative approach that yields high values of velocities and accelerations. Peak velocity and acceleration components are determined for the transverse, longitudinal, and vertical axes, and the magnitudes of the resultant velocity and acceleration vectors are computed using the peak values. The actual velocity and acceleration vectors that occurred at any given time are somewhat lower since the measured peak velocity and acceleration components rarely, if ever, occur at the same time. This approach results in an overestimation of the actual magnitude of velocities and accelerations.

39. First, all velocity data were reduced and plotted in terms of resultant particle velocity versus scaled distance as shown in Figure 11. The data all fell within a reasonably narrow band. A straight-line fit of the data, visually biased for the 1975 La Pita Hill records, provided a general guideline for anticipated velocities at various scaled distances. The La Pita Hill velocity data were shown to be in general agreement with velocity data collected elsewhere along the Canal. Secondly, acceleration data were reduced and plotted versus scaled distance as shown in Figure 12. The specific data from La Pita Hill yielded a satisfactory distribution and provided a general means of predicting the accelerations at various scaled distances. As can be seen, the acceleration data from records taken at all points along the Canal show more scatter than the velocity data and are therefore more site dependent than the velocity records. For this reason, extrapolation beyond the boundaries of measurement are more questionable. A straight-line fit of the data, again visually biased for the records obtained at La Pita Hill, provided a general guideline for anticipated accelerations at various scaled distances. Although the data are scattered somewhat, the La Pita Hill acceleration data are shown to be in general agreement with data collected elsewhere.

Data Evaluation

40. The method of computing the magnitude of the acceleration and velocity vectors was discussed in paragraph 38. It was stated that the method overestimated the actual magnitude(s) at a given time. The seismographic data were subsequently reevaluated to determine the magnitude of the actual measured accelerations as opposed to the magnitude of the computed accelerations. In a manner of speaking, the reevaluation established an appreciation of the safety factor imposed upon the stability analysis as a result of the method of data reduction. The velocities and accelerations for the recent blasts opposite La Pita Hill were recomputed, and the results are shown in Table 3. For each blast and each instrument, the velocity and acceleration magnitudes were calculated for the point in time when each of the three axes recorded a peak value; also shown are the calculated magnitudes of velocities and accelerations computed from the vectoral sum of the individual peak values. The amount of conservatism is immediately evident when comparing the values. This aspect has been discussed by Lutton (1976). Results indicate that the peak acceleration values, computed as discussed previously, average 34 percent higher than the magnitude of the maximum recorded acceleration vectors.

41. The degree of conservatism within the acceleration data developed for the analysis is further evidenced by the lack of consideration of the direction in which the acceleration vectors act. All accelerations within the analysis are imposed as horizontal loads to the slope in the downslope direction, when in fact, 68 percent of the measured peak accelerations were determined to act in the vertical direction. The remaining 32 percent were approximately evenly distributed between the transverse and longitudinal directions, suggesting that approximately 16 percent of the peak accelerations occur along a line perpendicular to the Canal. If it is assumed that half of these were directed upslope and half down, then only 8 percent of the peak accelerations measured would represent horizontal driving forces to the potential slide mass in

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a direction toward the Canal. While it is recognized that vertical accelerations reduce the normal stress in the failure mass, thereby reducing the shear strength, horizontal accelerations were considered as more critical due to the driving forces imparted to the failure mass.

42. Another argument for conservatism involves blasting records indicating numerous blasts of 40,000 lb between 1000 and 2000 ft away from the centroid of the potential slide mass on the hill. The maximum of these blasts, using acceleration versus scaled distance relationships developed for the present analysis, would have caused an acceleration at the centroid of the assumed failure mass of 1.95 g's, as shown in Table 4. While the actual response of the hill to those blasts is not known, failure obviously did not occur, thus confirming the conservative nature of the acceleration versus scaled distance relationships being used. The acceleration interpretation techniques are thus recognized and proven conservative.

43. However, none of the data used in evaluating accelerations and particle velocities were taken at the toe of La Pita Hill. Thus, when blasting occurs at the toe, the possibility exists for changes in the transmitted wave forms and the transmission mechanisms due to the change in the transmission path. In addition, the relatively complex nature of the site and the recognition of the consequences of a blast-induced slide cause the interpreted conservatism within the blast data to be a matter of concern. It was therefore decided to use the accelerations computed from the vectoral sums of the individual peak values as a self-induced safety factor for the analysis.

44. At the present time the only seismographic measurements which have actually been recorded on La Pita Hill are those which were acquired specifically for this study. The maximum velocity recorded on the hill was on the seismograph located at sta 1831+00, offset 500 ft east, for blast 17 (Figure 3). The blast, located at sta 1836+50 on the west bank, had a charge weight of 2642 lb, and produced a maximum resultant velocity of 7.3 in./sec at the recording station. The subsequently computed acceleration for the blast was 0.91 g. It should be pointed

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out, however, that both seismographs were placed upon the surface and
the velocities measured were the velocities for only the overburden
materials. Since the overburden would tend to resonate and thus amplify
the velocities and the subsequently computed accelerations, it is probable
that these surface measurements are somewhat higher than the average for
the entire potential failure mass and their use represents yet another
form of conservatism.

45. In an attempt to more precisely define and evaluate the
dynamic response of La Pita Hill for stability analyses, an acceleration
profile was developed. Although the general acceleration data measured
for the Canal (Figure 12) were used to obtain acceleration versus scaled
distance relationships, the constructed line was visually biased to
represent the average of the data obtained from recent Canal deepening
operations opposite La Pita Hill (Figure 3). As a means of evaluating
the developed acceleration versus scaled distance relationship and
establishing its validity for use in analysis, accelerations for the
recent (1975) blasts at La Pita Hill were recomputed using Figure 12.
The results obtained were reasonable and fell within the expected ranges,
as shown in Table 5. To facilitate the stability analysis of the hill,
the relationship so developed was assumed to apply to any weight charge
detonated at any location. To develop a profile, it was assumed that a
charge of arbitrary weight was detonated at the toe of the slope, 10 ft
east of the prism line (260 ft east of the Canal center line at
sta 1831+00). The resulting acceleration occurring at the centroid of
the initially assumed potential slide mass was designated as being
100 percent. The corresponding acceleration of other points along the
section were expressed in terms of percent of the acceleration at the
centroid (Figure 13). From such a plot it is possible, as discussed
later, to study the potential effects of a blast detonated at the toe of
the slope in terms of a distributed acceleration using pseudostatic
techniques of stability analysis.

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PART IV: LABORATORY TEST RESULTS

Prior Laboratory Tests

46. At the beginning of this study, the only laboratory test
results available on materials from the Las Cascadas formation were
those performed on six samples by the U. S. Army Engineer Division,
South Atlantic (SAD) Laboratory for the U. S. Army Engineer District,
Jacksonville (1968). A summary of those results has also been published
by Banks et al. (1975). The samples tested were described as agglomerate,
tuff, and shales taken from boring D1 during the Atlantic-Pacific Inter-
oceanic Canal feasibility studies. Results of these tests, as well as
recent testing, are summarized in Table 6.

47. The SAD testing program consisted of unconfined compression
and direct shear tests as well as the determination of index values.
The direct shear tests were performed on remolded precut, undisturbed
intact, and undisturbed precut specimens with peak and ultimate strengths
being determined for each type specimen. The laboratory test reports
are reproduced in Appendix B (pages B2 through B10).

Recent Laboratory Tests

48. During the recent boring program at La Pita Hill, undisturbed
samples were taken in borings ERE-26, ERE-27, and ERE-25A for the purpose
of laboratory testing. The sampling program was established after
completion of boring ERE-25. The log and core of boring ERE-25 were
studied, and selected zones of weaker and/or faulted and sheared material
were chosen for sampling. Samples of these zones were obtained by using
a rock bit to drill a new hole, boring ERE-25A, to desired sampling
depths at an offset of 8 ft from boring ERE-25. For borings ERE-26 and
ERE-27, general instructions were given the driller to sample the weaker
materials, i.e., tuffs, agglomerates, as well as weathered and gouge
zones. Samples from borings ERE-26 and ERE-27 were taken with a Denison
core barrel, and samples in boring ERE-25A were taken with a Shelby tube

sampler. A total of 26 samples were taken in the three borings. The samples were shipped to WES in the sample tubes, after which they were extruded, visually inspected, and photographed. Within approximately 5 min the samples were placed in cardboard tubes and encapsulated in a 50/50 mixture of microcrystalline wax/paraffin and stored in a humid room to await testing.

49. Ten samples were selected by WES for laboratory testing. Sample selection was based upon the desire to establish (a) differences in strength between the various layers, (b) the similarity of strengths at different locations within the various layers of tuff, and (c) the existing peak, ultimate, and residual strength parameters for various materials. To establish differences in strength parameters between various layers, six samples of tuffaceous and agglomeratic materials, one sample of andesite, and one sample taken in a fault or shear zone within agglomeratic tuff were chosen for single-plane direct shear tests in a rock shear device. For the agglomeratic tuff sample taken from the fault zone, a multistage direct shear test was performed because of the limited amount of sample available. In addition to the strength tests, index properties (i.e., water contents, unit weights, and Atterberg limits) were determined on each test sample.

50. For each test conducted in the rock shear device, specimens approximately 0.4 ft in length were sawed from the samples. The specimens were cemented in the two halves of the shear boxes with a mixture of water and Hydro-Stone Mix, leaving approximately a 1/16-in. opening between the two halves of the boxes to allow for axial displacements under consolidation and for shear. The specimens were then consolidated under normal loads of 4, 8, and 12 tsf, for approximately 10 min. The samples were sheared to failure at a rate of 0.002 in./min after which the strain rate was increased and shear continued for approximately 10 to 12 min. The strengths that were determined represented the peak and ultimate values for each of the samples. The ultimate strength represents the strength after initial failure of intact materials. Ultimate strength is distinguished from residual strength by the amount

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of displacement required. Ultimate strengths were defined as the strength occurring at a displacement of 0.42 in.; residual strength represents the minimum strength obtained after relatively large displacements or strains (i.e., displacements an order of magnitude larger than ultimate displacements (Banks et al., 1975)).

51. For the multistage direct shear test conducted on the faulted material, the sample preparation and performance of the tests were conducted as described previously. However, the strength envelope was determined using a single specimen rather than separate specimens for each normal load. For each shear strength determination the specimen was recentered and reloaded for each of the progressively higher normal loads. Pretest and/or posttest photographs for all of the samples tested in the rock shear device are shown in Appendix B, Figures B1 through B8. The laboratory test reports are presented in Appendix B (pages B13 through B44), and the test results are summarized in Table 6.

52. Three specimens of the weaker tuff layer were tested in a 3-by 3-in. direct shear box to determine the drained peak, ultimate, and residual strengths (i.e., c' and ϕ') for use in effective stress analyses. The intact specimens were trimmed to 3 by 3 by 1 in. by first roughly sawing them and then pressing them through a cutting mold. Normal loads of 4, 8, and 12 tsf were placed on the specimens. The specimens were then consolidated for approximately 24 hr, at which time it was determined from a plot of the change in specimen height versus time that consolidation was essentially complete. The specimens were inundated with distilled water 2 min after the consolidation was begun and maintained that way for the remainder of the test. The specimens were sheared at a rate of 0.00008 in./min for a total of 5 days (approximately 0.5 in. in 5 days) to obtain the peak and ultimate values. At that time, the shear rate was increased to 0.03125 in./min (0.25 in. in 8 min), and the specimens were rapidly sheared to residual. A total of 10 in. of displacement was accumulated during the rapid shear, after which the rate was reduced to 0.00008 in./min for obtaining the residual strength. The peak and ultimate values determined were $c' = 0.4$ tsf and $\phi' = 38$ deg and $c' = 0$ and $\phi' = 25$ deg, respectively. The test

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results for the peak and ultimate tests have been included in Table 6,
and the laboratory test report has been presented in Appendix B (page B46).
The results obtained from the residual tests were erratic and did not
provide suitable data for an evaluation. An inspection of the shearing
surfaces after completion of the tests showed the materials to be broken
without the establishment of distinct failure planes. The failures
within the shear boxes had occurred diagonally through the specimens and
in one case had exited through the top and bottom of the test specimen.

53. The final tests conducted were performed solely to establish
the residual strength of the weaker tuff layer. The tests were con-
ducted by shearing the specimens along precut failure planes. Precut
failure planes for the tests were fabricated by trimming three sets of
two 3- by 3- by 1-in. test specimens to 3 by 3 by 1/2 in. and placing
them together in the direct shear boxes. The specimens were then con-
solidated under normal loads of 4, 8, and 12 tsf for a total of 46 hr.
Again the specimens were inundated 2 min after the consolidation was
begun and maintained that way for the remainder of the test. The speci-
mens were sheared in 0.25-in. increments at a rate of 0.03125 in./min,
i.e., 0.25 in. in 8 min, until a total displacement of 5.0 in. had been
accumulated. At that displacement, the maximum shear stress for each
increment had stabilized. The specimens were then centered, left under
normal load overnight, and sheared twice the following day at a rate of
0.5 in. in 24 hr. The readings from the second shear were used for
computing residual values. The residual strength for the tuff as deter-
mined from the test results was $c' = 0.0$ tsf and $\phi' = 8.3$ deg. The
test results have been included in Table 6, and the laboratory test
report is presented in Appendix B (page B47).

Laboratory Index Parameters

54. Laboratory index parameters, i.e., water contents, unit
weights, and Atterberg limits, were determined for each sample tested.
The index parameters provide a useful means of comparing materials and

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establishing similarities in behaviors and properties. The results of the index tests have been included in Table 6.

55. The laboratory-determined water contents for the samples of tuff and agglomerate tested ranged from 15.7 to 29.3 percent with exception of the tuff in sample 4 from boring ERE-27. The tuff in sample 4 was highly weathered and had water contents ranging from 38.9 percent to 42.1 percent. The andesite tested exhibited lower water contents of 11.7 to 12.1 percent. The dry unit weights, with exception of sample 4 from boring ERE-27, ranged from 95.0 to 120.3 pcf for the tuffs and agglomerates and corresponded to the same specimens for which the high and low water contents were measured. The dry unit weights for sample 4 ranged from 77.5 to 79.5 pcf. The dry unit weights of the andesite were somewhat higher, ranging from 128.4 to 129.0 pcf. Laboratory test results reported by SAD for the Las Cascadas formation, as shown in Table 6, generally indicated somewhat lower water contents and higher dry densities than those determined by WES. With regard to water content and dry density, the shale samples tested by SAD appear to correlate with the tuff samples tested at WES as part of this study. The agglomerates and tuffs previously tested indicated significantly higher dry densities than the current specimens.

56. The Atterberg limits for the specimens indicated the consistency of properties within the different samples tested. As shown in Table 6, the liquid limits for the tuffs ranged from 76 to 99, the plastic limits ranged from 30 to 57, and the plastic index ranged from 40 to 58, all indicating reasonably narrow ranges of values. The liquid and plastic limits of the tuff previously tested by SAD fell within the ranges determined for the La Pita Hill samples. The agglomerate tested at WES during this study indicated a somewhat higher liquid limit, a significantly lower plastic limit, with a subsequently higher plastic index when compared with that tested by SAD, suggesting that the agglomerate tested by SAD was perhaps of different origin than that found at La Pita Hill. No limits were obtained for the andesite, due to the sample being inadvertently omitted from the testing program. A plot of

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the limit parameters on a plasticity chart (Appendix B, page B59) shows half of the samples tested during this testing program below the A-line, resulting in a classification as MH materials.

Laboratory Strength Parameters

57. To establish appropriate strength parameters for use in a total stress analysis (i.e., c and ϕ), all of the peak shear stresses and all of the ultimate shear stresses obtained from the single-plane direct shear tests were plotted versus normal stresses in Figures 14 and 15, respectively. As can be noted, the peak shear strength results, Figure 14, indicated a large amount of scatter, and due to the limited number of tests performed, only general trends were indicated.

58. The ultimate shear strength plot (Figure 15) yielded somewhat more consistent data. The agglomerate tested yielded the highest strength, followed by the andesite and then the tuff. For determination of the tuff strength, an average of the shear stress values recorded for each normal load was used. In addition to the ultimate strength providing the most interpretable values, it can be shown that the ultimate strength is most applicable to the type analysis under consideration. Peak strengths are developed in very small movements and residual strengths are developed only after very large displacements, thus leaving a very broad range of displacements or strains in which ultimate strengths are applicable for use. It has been noted in Report 3 (Banks et al., 1975) that the displacements inherent within the majority of the materials along the Canal are such that current strengths for the materials can be estimated by the ultimate strength of intact specimens.

59. The assumption of ultimate strength applicability was supported by the results of the drained tests on intact specimens and the multistage direct shear tests on faulted and broken materials. The results of the multistage test, reported in Appendix B, pages B42-B44, indicate the same peak and ultimate values for the faulted and broken tuff sample. Since it was clearly demonstrated with the drained test that residual

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strength for the material is considerably lower than the peak and ultimate values, i.e., the materials tested were not at residual strength in situ, the ultimate strength appears most applicable when failure is assumed in broken and/or faulted materials, as with this analysis.

60. As previously stated, the ultimate strength of the tuffs, shown in Figure 15, was determined by averaging the shear strengths recorded in all the tests for each normal load. The plotted results indicate ultimate shear strengths of $c = 1.0$ tsf and $\phi = 30.5$ deg for the tuffs, $c = 1.5$ tsf and $\phi = 32.6$ deg for the andesites, and $c = 2.7$ tsf and $\phi = 29.9$ deg for the agglomerates. For the purposes of analysis, the layers of tuff and tuff breccia were assumed to have the same strength, $c = 1.0$ tsf and $\phi = 30.5$ deg. In addition, the ash flow layer (ignimbrite) within the hill was assigned the same strength as agglomerate (i.e., $c = 2.7$ tsf and $\phi = 29.9$ deg) since much of the agglomerate logged in borings at La Pita Hill was described, in supplemental information provided, as being ignimbrites.

PART V: STABILITY ANALYSIS

61. The geologic structure, as previously discussed, was simpli-
fied from a rather complex structure composed of interbedded sequences
of tuff, agglomerate, ash flow, andesite, and overburden crosscut by
numerous joints, faults, sheared zones, and fault zones to a more simple
layered system. This simplification was accomplished as described in
Part II without any major compromises in lithologic interpretation.

62. Pore pressures and groundwater conditions were evaluated, as
discussed in Part II, and were used to develop appropriate pore pressure
parameters associated with the upper and lower limits of the interpreted
groundwater levels. The pore pressure parameters were used only for the
semiempirical two-dimensional effective stress analysis.

63. Strength parameters for the analyses were chosen after a
comprehensive review of available data. For the semiempirical analysis,
the upper and lower limits of strengths for failures along faults and
through materials weakened by faults, as determined from back analyses,
were obtained from Report 3 (Banks et al., 1975). In the conventional
stability analysis, ultimate total strengths, as discussed in Part IV,
were chosen from laboratory test results.

64. Accelerations of various magnitudes were used to determine
the response of factor of safety to dynamic loads. The methods chosen
for applying the accelerations, as discussed in Part III, were uniformly
applied accelerations and distributed accelerations lying along developed
acceleration contours.

Methods of Analysis

Semiempirical analysis

65. A semiempirical analysis was performed at the beginning of
the study, prior to obtaining any supplemental geologic or water table
data. At the time of the analysis, the existence of the possible fault
(C-C, Figure 3) paralleling the Canal, which could potentially represent

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the back scarp of a slide, had not been confirmed or disproved. This
fault and the apparent bedding dip obtained from existing cross sections
furnished by the PCC were used in establishing a potential failure plane
exiting at the toe of the slope. The assumed failure planes for the
existing condition and for the section after deepening are shown in
Figure 16.

66. The semiempirical analysis was conducted in accordance with
procedures used for back analyses presented in Report 3 (Banks et al.,
1975). The La Pita Hill study represents the first opportunity for WES
to analyze an existing stable slope and to compare the results as obtained
from recommendations in Report 3 with those obtained by a more conven-
tional approach. As reported in Report 3, the semiempirical method of
analysis serves as a useful tool in obtaining rapid estimates of the
factor of safety based primarily upon previous experience in similar
materials. It should be pointed out that relatively few failures have
been experienced in the Las Cascadas formation; therefore, the conclu-
sions gained from back analyses are more speculative than those made,
for example, in the Cucaracha formation.

67. The selection of applicable strengths for the analysis required
the description or characterization of materials at La Pita Hill into an
appropriate category with which experience has been gained in the back
analysis of slides occurring in the Las Cascadas formation. Based upon
boring logs currently available and discussions with Mr. Robert Stewart,
PCC geologist, the material was considered to be such that if failure
occurred the slide surfaces would be primarily along faults and in
materials weakened by faults. As a result, strength parameters of
$c' = 600$ psf and $\phi' = 20$ deg, and $c' = 0$ psf and $\phi' = 20$ deg were
chosen as upper and lower limits from Table 5, Report 3 (Banks et al.,
1975), and were applied along the entire failure surface.

68. The influence of the water table upon the factor of safety
was evaluated by performing the semiempirical analysis with both the
maximum and minimum levels as determined from available BSSP data. The
strengths obtained from back analyses were obtained using a pore pressure

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parameter r_u, defined as the ratio of the pore pressure to the total pressure at a point (Bishop, 1954). The total pressure is assumed to be the vertical pressure caused by the weight of all material vertically above the point in question, including external water if present. Therefore,

$$r_u = u / \sum_{i=1}^{n} \gamma_i h_i$$

where

u = the pore pressure, psf

γ = the total unit weight of material in layer i, pcf

h = the vertical thickness of layer i, ft

Pore pressure parameters computed for the upper and lower water surfaces, $r_u = 0.32$ and $r_u = 0.23$, respectively, were used in the analysis in computing average pore pressures for the entire failure mass.

69. The analysis was performed using the WES version of the Morgenstern and Price computer program. Initially, the section was analyzed using the existing geometry to determine the current factor of safety and to evaluate the influence of the water table on the factor of safety. In the analysis, several arbitrary strengths were chosen and safety factors computed. The factors of safety (FS) were used to develop a c'/FS versus $\tan \phi'/FS$ plot. The factors of safety for $c' = 0$ psf and $\phi' = 20$ deg and $c' = 600$ psf and $\phi' = 20$ deg with the limiting pore pressure assumptions were subsequently computed as shown in Figure 17. The factors of safety so determined were as follows:

	Factors of Safety for Assumed Limiting Strength Parameters	
	Lower Limit $c' = 0$ psf, $\phi' = 20$ deg	Upper Limit $c' = 600$ psf, $\phi' = 20$ deg
Upper groundwater surface, $r_u = 0.32$	1.20	1.31
Lower groundwater surface, $r_u = 0.23$	1.25	1.38

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The section was next analyzed assuming 9-ft deepening of the Canal at the toe. The results and computations of factors of safety for this condition have been shown in Figure 18. The factors of safety for this case were as follows:

	Factors of Safety for Assumed Limiting Strength Parameters	
	Lower Limit $c' = 0$ psf, $\phi' = 20$ deg	Upper Limit $c' = 600$ psf, $\phi' = 20$ deg
Upper groundwater surface, $r_u = 0.32$	1.15	1.27
Lower groundwater surface, $r_u = 0.23$	1.26	1.38

70. As a final stage of the semiempirical analysis, several different accelerations were uniformly applied as horizontal forces to the slope in an effort to pseudostatically determine the response of the slope to dynamic loads. These analyses were made for the section with a 9-ft cut at the toe using the high groundwater surface, i.e., $r_u = 0.32$. Results of the analysis in terms of factor of safety versus acceleration for each of the limiting strength assumptions is presented in Figure 19. To reduce the results to a more usable form, the scaled distances, $R/W^{1/3}$, for each of the analysis accelerations were plotted versus factor of safety in Figure 20. The scaled distances were determined from the straight-line fit of the acceleration data, as described in Figure 12. As a final presentation of the results, the scaled distances determined from Figure 20, which represent a factor of safety of 1.0, were used to develop a graph of charge weight versus distance from blast to the centroid of the assumed failure mass (Figure 21). The distances and weights in Figure 21 represent minimum distances and maximum charge weights allowable for a factor of safety of 1.0.

Conventional static analysis

71. A conventional two-dimensional stability analysis was performed for La Pita Hill using the presently defined geologic profiles with appropriate laboratory determined strengths within the various strata.

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72. The critical failure surface for the slope was defined by a systematic set of trial runs with the problem. Initially, a back scarp to the failure plane was assumed to be inclined at 45 deg toward the Canal and to enter the ground surface at a distance of 1000 ft from the Canal center line. A base plane for the failure surface was then assumed to be inclined along the dip of the beds toward the Canal. For the initial set of computations, the back scarp was left fixed, and the depth at which the failure plane exited the slope was varied to determine the factor of safety. The results, plotted in Figure 22, indicated two failure planes with low factors of safety. The first, possessing the lower factor of safety (FS = 2.93), hereafter called the upper plane, was in one of the tuff layers above the Canal water surface, and the second (FS = 2.99), hereafter called the lower plane, was in the more competent agglomeratic material below the bottom of the Canal. The proposed 9-ft deepening of the Canal was evaluated to determine the effect of the lower plane because of its somewhat more critical location. It was determined that the deepening operations resulted in a reduction in factor of safety of approximately 6 percent. In view of the reduction in the factor of safety and still somewhat incomplete geologic picture at the toe of the slope with the subsequent potential for daylighting weaker beds, it was decided to continue the analysis of both failure planes.

73. The next step in identifying the critical failure planes was to vary the length of the base of each of the failure planes along the strata as defined in the first step. With the locations and inclinations of the base planes fixed and with the back scarps fixed at 45 deg, as previously, the factors of safety were plotted versus distances to the back scarps (Figure 22) to determine the critical lengths of both the upper and lower failure planes.

74. Finally, with the exit elevations and base plane for each failure surface fixed, the inclinations of the back scarps were determined by a similar procedure. Factors of safety were plotted versus the locations at which the back scarps entered the slope (Figure 22) to

define the critical failure surfaces and their lowest factors of safety for the analysis. The factors of safety determined for the conditions analyzed were as follows:

	Factors of Safety	
	Upper Plane	Lower Plane
Prior to deepening	2.12	2.59
After deepening	2.12	2.45

Pseudostatic analysis
with uniform accelerations

75. An analysis to evaluate the influence of accelerations imposed upon the slope was conducted using the two critical failure surfaces determined with the conventional static analysis. For the purposes of analysis, the accelerations were imposed as horizontal loads upon the slope, similar to the pseudostatic method used in evaluating the effects of earthquakes upon a slope.

76. Initially, uniform accelerations were applied to the slope. The results of the analysis in terms of factor of safety versus acceleration are shown in Figure 23. To further evaluate the data, the scaled distances taken from Figure 12 for each acceleration were used, and a plot of factor of safety versus scaled distance was developed as shown in Figure 24. For the purpose of obtaining blast design data, a plot of charge weight versus distances to the centroid of the assumed failure mass was developed from the scaled distance corresponding to a factor of safety of 1.0. The plot shown in Figure 25 represents minimum distances and maximum charge weights, as with that previously developed in the semiempirical analysis.

Pseudostatic analysis
with distributed accelerations

77. The use of distributed or partitioned accelerations, within a slope being analyzed, more realistically represents the forces involved than the assumption of uniform accelerations. The hill was thus analyzed using the acceleration contours previously mentioned and shown in

Figure 13. These contours were used in distributing various assumed accelerations at the approximate centroid of the previously assumed slide mass under the assumption that the accelerations were generated by an arbitrary charge located at the toe of the slope. The distribution of the accelerations away from the centroid of the mass have been included in Figure 16 immediately beneath the surface profile.

78. The use of partitioned accelerations increased the complexity of the problem being analyzed many times. Thus, to simplify the problem and facilitate computations, equivalent uniform strengths were determined for the entire slope such that their use in a stability calculation would yield the same factor of safety as that given by the conventional analysis using the upper and lower planes. Several arbitrary strengths were assumed to develop a c/FS versus $\tan \phi/FS$ plot (Figure 26), from which equivalent uniform strengths could be determined. Thus simplified, the slope consisted of one soil mass with $c = 0$ and $\phi = 36.11$ deg. The equivalent uniform strength that was chosen for use in further analyses of both the upper and lower planes was associated with the upper, more critical failure surface.

79. The extremely high accelerations imposed upon the toe of the slope caused the majority of the solutions using the Morgenstern and Price computer program to be nonconvergent. None of the solutions involving the upper plane converged, and only two solutions for the lower plane converged. The results were, however, adequate for demonstrating the effect and the importance of using distributed accelerations for nearby blasts.

80. The results of the analysis with distributed or partitioned accelerations have been plotted in Figure 27. The nonconvergent solutions were included in the plot to aid in demonstrating the trend. The results are further reduced in Figure 28 with a plot of factor of safety versus scaled distance, which was determined by methods previously described. Finally, from the scaled distance representing a factor of safety of 1.0, a plot of charge weight versus distance to the centroid of the slide mass (Figure 29) was developed.

Results of Analyses

81. The results of the analyses show La Pita Hill to be stable against a massive failure as it presently exists by both the semiempirical analysis and the conventional two-dimensional static analysis. The semiempirical analyses produced factors of safety ranging from 1.20 to 1.31 using the maximum pore pressure parameter and the upper and lower limits of the strength parameters. The conventional analyses, using existing total strengths, yielded factors of safety of 2.12 for an upper failure surface and 2.59 for a failure surface below the Canal bottom, prior to excavation.

82. Factors of safety computed for a section after the proposed deepening indicate a reduction in factor of safety of approximately 4 percent for the semiempirical analysis and 6 percent for the conventional analysis. After deepening, the semiempirical analysis indicated factors of safety ranging from 1.15 to 1.27 for the upper and lower limits of the strength parameters with maximum pore pressures conditions. It should be noted that the semiempirical analysis indicated no appreciable change in factors of safety after deepening for the minimum pore pressure conditions (Figures 17 and 18). The conventional analysis yielded a factor of safety of 2.45 for the lower failure surface. The upper failure surface remained at 2.12, as it was unaffected by the deepening.

83. Results of the pseudostatic analyses of the slope were highly variant depending upon the analysis technique. For a factor of safety of 1.0 the semiempirical analysis indicated the maximum allowable charge weight, assuming the blast 260 ft east of the Canal center line (at the toe of the slope, 10 ft east of the prism line), was 50 lb for the minimum strength parameters, $c' = 0$ and $\phi' = 20$ deg, and was 87 lb for the maximum strength parameters, $c' = 600$ psf and $\phi' = 20$ deg. For the conventional analysis with uniformly applied accelerations and for a blast at the same location as above, the results indicated that a maximum allowable charge weight of 165 lb for the upper failure surface

and 360 lb for the lower failure surface produced a factor of safety of 1.0. The final analysis, utilizing distributed accelerations, indicated that a maximum charge weight of 145 lb at the toe of the slope produced a factor of safety of 1.0 for the lower failure surface.

84. A copy of each of the computer runs representing the low factors of safety as well as the run demonstrating the effect of using distributed accelerations is contained in Appendix C.

Comparison of Results

Static analysis

85. Both the semiempirical and the conventional two-dimensional analyses indicated the hill to be stable against massive failure prior to and after completion of deepening with the safety factor decreasing 4 to 6 percent as a result of the excavation. The differences in the factors of safety obtained by the two methods is attributable primarily to the differences in assumptions that were inherent within each method.

86. The semiempirical analysis used effective strengths that were back-calculated to be the strength existing at the time of failure of various slides within the Las Cascadas formation. The true significance of a factor of safety can only be evaluated through much more experience and many correlations with results obtained from conventional type analyses. An additional assumption necessitated by the semiempirical effective stress analysis was the use of average r_u values in describing pore pressure conditions.

87. The conventional stability analysis used total strengths rather than effective strengths. As a result, the water table and pore pressure conditions, as they exist within the hill, were not used directly within the analysis.

88. The conventional analysis was conducted to obtain design results to base recommendations upon, while the semiempirical analysis was run to establish a base point in the analysis and to demonstrate the use of the method. The semiempirical analysis can be and was used with

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no supplemental geologic or water table data to determine an approxima-
tion of the factor of safety for La Pita Hill. It is obvious in comparing
the results that the semiempirical analysis is very conservative, and
this should be recognized during future use of the method.

Pseudostatic analysis

89. The differences in the results obtained with the pseudostatic
analyses are primarily attributable to the method of stability analysis
used. The low allowable weights at the toe of the slope obtained from
the semiempirical analysis are a direct result of the low factors of
safety obtained for the static conditions.

90. The disparities between the two different methods applied to
the conventional stability analysis are attributable to the acceleration
assumptions. The assumption of a uniform acceleration implies that the
blast is remote to the slope and that the acceleration distribution
contours are so widely spaced that the entire potential failure mass is
acted upon by an approximately uniform acceleration. On the other hand,
the analysis performed with the distributed accelerations implies a
blast near the slope and reflects the actual acceleration gradient or
distribution with distance. The particular distributed acceleration
analysis performed, however, was for one blast of arbitrary weight
detonated at the toe of the slope; the contours and subsequent results
of the analysis would change if an evaluation were to be made at a
different location.

91. The results of the two pseudostatic analyses thus represent
limiting assumptions for evaluating the dynamic response of the hill.
For a blast at the toe of the slope, the distributed acceleration type
analysis is more applicable. For a blast at a reasonable distance from
the slope, the results obtained from the two different methods become
more nearly the same, and thus the uniform acceleration assumption becomes
more applicable. The two different solutions may be properly used in
assessing the predicted behavior of La Pita Hill if proper recognition
is given to the inherent assumptions and limitations. The choice of
results to use is theoretically a function of each blast location. A

generalized evaluation of accelerations using theoretically correct acceleration distributions was not within the scope of this report.

Applicability of Results

92. The results obtained in the above stability analyses are conservative if it is assumed that (a) the geologic structure of the hill has been completely defined, (b) representative samples were obtained for laboratory testing, (c) the laboratory test results are indicative of in situ mass strength, (d) the pore pressures generated during testing duplicated in situ pore pressures that would occur during shear, and (e) the dynamic response of the hill is consistent with the acceleration assumptions. The origin of the conservatism is inherent within the accelerations used in the analysis and the high pore pressure assumptions; i.e., a conservative approach was used in obtaining acceleration data and the pore pressure conditions were maximized for the analysis by using data associated with a perched water table in the hill.

93. The highly complex nature of the slope and the complicated mode by which blast-induced accelerations are distributed, however, tend to suggest the possibility of a certain amount of uncertainty in the definition of the problem. An evaluation of previous blasts in the area of La Pita Hill, i.e., determination of maximum plateau of previous accelerations, indicates that the conservatism outweighs the uncertainties involved, since previous blasting has not generated failures at La Pita Hill even though the estimated accelerations exceeded those computed to induce failure.

94. The results are thus considered appropriate for design recommendations, and it is assumed that recommendations based upon a factor of safety of 1.0 are applicable considering the conservatism inherent within the results obtained.

PART VI: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

95. An evaluation of the current conditions of La Pita Hill indicates the hill to be stable against massive failure as it presently exists. Neither surface nor subsurface motion vectors have recorded any movements of consequence to date. Water level data for the hill indicate a perched water table at approximately the base of the overburden, with subsequently lower piezometric heads being recorded in the free draining layers of broken materials deeper within the slope.

96. The present stability against massive failure was confirmed by both the conventional total stress analysis and the semiempirical effective stress analysis. Additionally, both analyses indicated the hill to be stable after completion of the anticipated 9-ft deepening of the Canal. The deepening of the Canal was shown to reduce the factor of safety by approximately 6 percent.

97. The dynamic stability of La Pita Hill has, to an extent, been tested in the past by blasting operations in the immediate area. Although the hill was not instrumented during production and Canal widening blasts in the area, back computations for the blasts indicate that significant accelerations were imposed upon the slope during these operations. The results of the stability analyses for massive failure indicate a definite potential for instability of the hill when subjected to blast-induced accelerations. While the hill has in the past withstood higher computed accelerations than those calculated to cause failure, the effect on, or change in, material properties as a result of blasting is not known; therefore, the stability as effected by blasting is still a matter of concern. Recommendations have thus been made to control the magnitude of the accelerations imposed upon the hill during blasting operations for the current Canal deepening project.

Recommendations

98. For current design requirements, it is recommended that blasting in the vicinity of La Pita Hill be regulated or controlled so that a factor of safety of 1.0 is maintained according to the results computed by the conventional two-dimensional analysis using uniform accelerations imposed upon the failure mass. For blast design computations, the curve relating the distance from the blast to the centroid of the potential failure mass versus charge weight of the blasts for the upper failure surface (Figure 25) was used to develop the design curve shown in Figure 30. The centroid of the assumed critical slide mass is located at sta 1831+00, offset 572 ft east of the Canal center line. This centroid should be used in computations of distance to a proposed blast location. The design curve (Figure 30) represents the charge weight and distance from centroid combinations, which the analyses indicate yield a factor of safety of 1.0. Combinations of weight and distance plotted above the curve have factors of safety greater than 1.0, and those plotted beneath the curve are less than 1.0. The conservatism in the design recommendations is supported by the data points taken from Canal widening blasts at La Pita Hill plotted below the curve (Figure 30). The maximum allowable blast weights for the critical failure surface have been shown graphically in Figure 31. The contours in Figure 31 represent the minimum distances with the maximum allowable charge weights for maintaining a factor of safety of 1.0 for the hill.

99. It is recommended that during blasting operations a seismograph be placed approximately at the centroid of the failure mass, i.e., sta 1831+00, offset 572 ft east, and that particle velocities be monitored and accelerations computed. As an additional check on the blast design recommendations, the accelerations computed for the blasts should not exceed those in Figure 23 for a factor of safety of 1.0 for the upper more critical failure surface.

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General Recommendations

100. In performing the preceding analyses, several areas were noted in which the addition of new or supplemental information could be used to an advantage in defining more completely the structural geology and engineering properties of La Pita Hill.

101. Subsurface information should be supplemented in the areas of fault identification and further evaluation of the geology along the toe of the slope. The hill is obviously faulted to a great extent, and the placement of future borings at the site should be made in an effort to more precisely identify the extent of faulting. The geology along the toe of La Pita Hill is perhaps the least defined with regard to stability analyses. Future borings along the toe should be extended well below the bottom of the Canal, and special efforts should be made to determine the possible existence of any beds of weak materials.

102. In addition to the need for completing the structural identification of La Pita Hill, there is a very real need for samples to be acquired for laboratory testing purposes. The Las Cascadas formation has the least information available on strength parameters of all the major formations through the Gaillard Cut. In the future, each time a boring is placed in this formation, consideration should be given to acquiring and testing samples. Through continued testing (along a more routine basis) a data bank will gradually develop that will prove valuable in studying other slopes within the formation.

103. In view of the frequency with which the slopes along the Canal are loaded dynamically, i.e., frequent blasting within the Canal, it is suggested that in addition to sampling for future conventional laboratory tests, specific samples be acquired for cyclic triaxial shear testing. Possible changes in material properties resulting from blasting should be inferred or identified and subsequently used in future slope evaluations.

104. Additionally, it is recommended that the monitoring of blasts be continued during future operations. This analysis has served

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to illustrate the relative effects that blast-induced accelerations can have on a slope. For marginally safe slopes, the effects could easily be enough to cause instability, and any blasts in such areas should be monitored whenever possible.

Recommendations for Comprehensive Blasting Design

105. While the primary purpose of this report is to provide recommendations for prevention of a massive failure of La Pita Hill, the total benefit of the report will not be realized unless a series of incremental reports are completed for selected slopes along the Canal. The combined results of a series of detailed analyses, supplemented with semiempirical analyses between slopes studied in detail, would provide the data base from which detailed blasting recommendations could be developed for the Gaillard Cut.

106. A final summary report is envisioned in which results of the above recommended incremental reports are coupled with recorded blasting experience in the Canal and are systematically applied to the entire Gaillard Cut. The development of final blasting recommendations would follow the step-by-step approach, outlined below and graphically illustrated in Figure 32.

   a. Select slopes for analysis contingent upon deepening locations and stability.

   b. Incrementally evaluate and provide design recommendations for selected slopes by conventional analyses.

   c. Perform semiempirical analyses on selected slopes.

   d. Perform semiempirical analyses on areas between selected slopes.

   e. Develop conventional analysis versus semiempirical analysis relationships for extrapolation to areas between selected slopes.

   f. Obtain experience records for Canal blasting.

   g. Develop slope height/slope angle versus blast weight relationships.

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  h. Plot b, c, d, and f using e and g to adjust the data and
    fill in the gaps.

  i. Provide final blasting recommendations determined from
    h.

  j. Adjust final recommendations as required by additional
    blasting experience.

107. Implementation of these final recommendations will provide
blasting recommendations based upon experience with Canal blasting,
experience with previous slides, and stability evaluations using present
strength criteria and current analysis techniques. When implemented,
these blasting recommendations will be readily adaptable to "fine tuning"
or adjustment, as additional blasting experience is gained during the
Canal deepening project.

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Table 1

Subsurface Information Available at La Pita Hill

				Boring Information			
Boring Designation	Date of Boring	Station ft*	Offset from ₵ ft*	Ground Elevation ft**	Depth ft	Water Level Elevation ft	Present Use
ERE-1	19 Jun 72	1827+23	440 E	209.2	214.7	83.5	EDM† station
ERE-2	21 Sep 59	1829+15	428 E	209.2	198.0	-	None
ERE-3	23 Sep 59	1830+28	445 E	182.6	190.2	152.6	EDM station, plain-cased deflection borehole
ERE-4	23 Sep 59	1830+77	493 E	207.4	208.9	(182.4)	Telemac
ERE-4a	(23 Sep 59)	1830+78	493 E	207.8	210.0	182.8	Plain-cased deflection borehole
ERE-5	27 Jul 72	1830+46	667 E	278.2	418.8	223.2	Plain-cased deflection borehole
ERE-6	26 Sep 59	1832+01.5	315 E	180.2	202.9	-	None
ERE-7	19 Sep 59	1832+00	765 E	319.5	252.0	-	None
ERE-8	8 Oct 59	1834+80	385 E	182.8	204.0	-	None
ERE-9	29 Sep 59	1833+80	564 E	245.5	251.0	-	None
ERE-10	1 Oct 59	1835+60	555 E	226.4	207.0	-	None
ERE-11	5 Oct 59	1838+45	370 E	174.0	210.0	-	None
ERE-12	1 Oct 59	1837+65	710 E	242.6	232.0	-	None
ERE-13	23 Sep 59	1840+54	295 E	95.9	113.0	-	None
ERE-14	28 Sep 59	1839+00	590 E	207.5	229.0	-	None
ERE-15	12 Jul 72	1829+05	577 E.	241.3	250.2	181.0	Plain-cased deflection borehole
ERE-18	23 Aug 72	1831+50	822 E	325.3	339.3	239.3	Plain-cased deflection borehole
ERE-20	24 Aug 72	1832+53	562 E	251.7	280.0	161.7	Plain-cased deflection borehole
ERE-25	22 Feb 75	1830+54	932 E	339.2	380.6	312.6	Core hole
ERE-26	22 Mar 75	1832+47	812 E	307.8	300.2	263.0	Core hole
ERE-27	11 Apr 75	1829+22	803 E	312.3	301.2	281.0	Piezometer
SC-82	25 Mar 47	1832+56	1128 E	346.2	392.7	302.2	EDM station, plain-cased borehole
LBE-19	3 Mar 73	1824+53	492 E	199.6	469.0	-	EDM station, plain-cased borehole
CDC-16	8 Jul 74	1822+50	250 E	83.2	80.0	83.2	Corehole
CDC-17	26 Jun 74	1827+C0	250 E	83.7	60.7	83.7	Corehole
CDC-18	28 Jun 74	1830+25	250 E	83.6	68.9	83.6	Corehole
CDC-19	1 Jul 74	1832+00	250 E	85.0	63.5	85.0	Corehole
CDC-20	3 Jul 74	1835+00	250 E	83.6	67.8	83.6	Corehole
CDC-21	25 Jul 74	1838+50	250 E	83.5	62.5	83.5	Corehole

*   Present station and offset.
** Feet above mean sea level (msl).
†   EDM = electronic distance measurement.

Table 2

Settlement and Alignment Monuments

Monument Designation	Station ft*	Offset from C_L ft*	Ground Elevation ft**	Present Use
0	1831+50	900.00 E	335.08	Settlement and alignment checks, and EDM[+] station
1	1831+50	840.00 E	333.36	Settlement and alignment checks
2	1831+50	754.37 E	291.56	Settlement and alignment checks, and EDM station
3	1831+50	724.33 E	287.98	Settlement and alignment checks
4	1831+50	694.70 E	278.96	Settlement and alignment checks
5	1831+50	666.13 E	270.36	Settlement and alignment checks
6	1831+50	632.81 E	265.67	Settlement and alignment checks, and EDM station
7	1831+50	603.69 E	251.43	Settlement and alignment checks
8	1831+50	577.94 E	245.08	Settlement and alignment checks
9	1831+50	521.78 E	208.47	Settlement and alignment checks
10	1831+50	503.76 E	207.00	Settlement and alignment checks
11	1831+50	485.01 E	203.18	Settlement and alignment checks
12	1831+50	458.80 E	191.91	Settlement and alignment checks
13	1831+50	421.67 E	184.14	Settlement and alignment checks
14	1831+50	399.78 E	180.12	Settlement and alignment checks

*   Present station and offset.
** Feet above mean sea level (msl).
[+] EDM = electronic distance measurement.

Table 3

Seismograph Data Evaluation for La Pita Hill

Blast No.	Velocity Seismograph No.	Transverse, Vertical, and Longitudinal Amplitudes at Maximum Value	Resultant Vector Velocity, in./sec			Resultant Acceleration with Transverse, Vertical, and Longitudinal Velocities at Maximum Value	Resultant Vector Acceleration, g			Percentage Increase of Maximum Acceleration (with Transverse, Vertical, and Longitudinal Values at Maximum Values over Maximum Instantaneous Acceleration)
			Instantaneous Velocity with Transverse Amplitude at Maximum Value	Instantaneous Velocity with Vertical Amplitude at Maximum Value	Instantaneous Velocity with Longitudinal Amplitude at Maximum Value		Instantaneous Acceleration with Transverse Velocity at Maximum Value	Instantaneous Acceleration with Vertical Velocity at Maximum Value	Instantaneous Acceleration with Longitudinal Velocity at Maximum Value	
1	4032	2.09	1.123	0.583	1.936	0.35	0.209	0.099	0.312	12.2
2	4032	2.26	1.704	0.708	1.840	0.42	0.312	0.116	0.249	34.6
3	4032	2.27	1.710	0.916	1.563	0.36	0.025	0.175	0.316	13.9
3	3409	1.61	0.636	1.177	1.396	0.20	0.058	0.149	0.138	34.2
4	4032	4.77	4.310	1.015	2.612	0.765	0.688	0.087	0.280	11.2
4	3409	1.56	0.833	0.829	1.119	0.20	0.124	0.059	0.133	50.4
5	3409	4.11	1.353	1.340	2.911	0.44	0.221	0.114	0.319	37.9
5	4032	2.42	1.467	1.597	1.911	0.36	0.238	0.217	0.290	24.1
6	3409	2.05	1.041	1.044	1.713	0.35	0.099	0.211	0.266	31.6
6	4032	2.23	1.127	1.596	1.686	0.33	0.210	0.219	0.244	35.2
7	3409	2.90	1.151	1.016	2.619	0.30	0.089	0.101	0.282	6.4
7	4032	3.34	1.791	2.275	1.118	0.53	0.270	0.240	0.003	96.3
8	3409	1.55	0.618	0.364	1.269	0.18	0.059	0.115	0.143	25.9
8	4032	2.70	2.240	1.815	2.454	0.41	0.335	0.292	0.370	10.8
10	3409	1.92	0.921	0.790	1.586	0.20	0.094	0.083	0.165	21.2
10	4032	2.92	0.960	0.729	2.840	0.51	0.156	0.190	0.458	11.4
11	4032	3.49	2.116	2.084	3.029	0.52	0.358	0.349	0.386	34.7
12	3409	5.27	3.376	4.037	3.420	1.17	0.696	1.021	0.650	14.6
12	4032	4.16	3.835	1.859	3.751	0.55	0.508	0.248	0.500	8.3
13	4032	1.83	1.089	0.932	1.459	0.30	0.186	0.174	0.207	44.9
14	4032	5.08	2.644	0.843	2.307	0.71	0.285	0.099	0.252	149.0
14	3409	1.25	0.676	0.480	1.030	0.180	0.094	0.082	0.149	28.6
15	4032	8.89	4.927	7.168	5.196	2.12	0.799	0.528	0.612	165.3
15	3409	1.73	0.879	1.182	1.557	0.240	0.137	0.164	0.210	14.3
16	3409	1.47	1.077	0.814	1.067	0.193	0.124	0.101	0.150	28.7
16	4032	5.69	2.218	4.882	3.663	0.95	0.336	0.846	0.533	12.3
17	3409	7.33	3.530	3.379	6.753	0.91	0.488	0.91	0.776	0.0
17	4032	7.32	4.966	6.137	1.842	1.31	0.856	1.31	0.256	0.0
18	3409	1.11	0.827	0.509	1.000	0.17	0.131	0.096	0.155	9.7
18	4032	10.16	7.613	6.946	7.646	1.35	0.940	0.950	0.907	42.1
19	3409	1.02	0.632	0.836	0.851	0.16	0.097	0.145	0.137	10.3
19	4032	7.59	5.378	21.794	5.097	1.40	0.443	0.778	0.814	72.0

Average percent increase 34.0

Table 4

Production Blasts - Canal Widening

Station ft		Offset (Assumed) ft		Distance to Centroid of La Pita Hill R, ft*	Weight W, lb	$W^{1/3}$	Scaled Distance $R/W^{1/3}$	Calculated Acceleration g**
Old	Present	Old	Present					
1647+75	1813+75	375 W	268 W	1935	20,000	27.144	71.29	0.215
1648+50	1814+50	365 W	258 W	1875	20,000	27.144	69.08	0.235
1647+50	1813+50	375 W	268 W	1950	20,000	27.144	71.84	0.212
1647+00	1813+00	375 W	268 W	1992	20,000	27.144	73.39	0.200
1645+00	1811+00	375 W	268 W	2150	250	6.300	341.27	<0.001
1646+50	1812+50	375 W	268 W	2030	20,000	27.144	74.79	0.188
1646+00	1812+00	375 W	268 W	2070	20,000	27.144	76.26	0.177
1646+00	1812+00	375 W	268 W	2070	20,000	27.144	76.26	0.177
1645+50	1811+50	375 W	268 W	2107	13,160	23.609	89.25	0.114
1659+25	1824+35	250 W	322 W	1200	10,000	21.544	55.70	0.425
1645+00	1811+00	375 W	268 W	2150	12,000	22.894	93.91	0.101
1658+80	1823+94	250 W	310 W	1212	2,160	12.927	93.76	0.102
1658+54 to 1658+60	1823+73	250 W	300 W	1217	4,125	16.038	75.88	0.181
1644+00 to 1648+65	1810+00 to 1814+65	375 W	268 W	2042	4,125	16.038	127.32	0.044
1658+35 to 1658+41	1823+60	250 W	295 W	1225	2,925	14.301	85.66	0.131
1658+16	1823+40	260 W	297 W	1240	3,000	14.423	85.97	0.128
1657+98 to 1657+92	1823+07	265 W	292 W	1255	3,051	14.504	86.53	0.126
1645+55 to 1652+27	1811+55 to 1818+27	350 W	243 W	1835	8,811	20.654	88.84	0.118
1651+56 to 1652+36	1817+56 to 1818+36	350 W	243 W	1630	1,500	11.447	142.40	0.0325
1656+00	1821+45	300 W	262 W	1363	10,000	21.544	63.27	0.300
1651+50	1817+50	350 W	243 W	1657	10,000	21.544	76.91	0.177
1648+00	1814+00	375 W	268 W	1915	500	7.937	241.28	<0.001
1653+32 to 1654+60	1819+26 to 1819+75	325 W	225 W	1483	10,000	21.544	68.84	0.237
1650+62 to 1651+73	1816+62 to 1817+73	350 W	243 W	1682	8,000	20.000	84.10	0.136
1651+56 to 1653+17	1817+56 to 1819+17	350 W	243 W	1604	9,000	20.801	77.11	0.172
1650+62	1816+62	350 W	243 W	1717	100	4.642	369.88	0.001
1650+50	1816+50	350 W	243 W	1723	5,000	17.100	100.76	0.084
1650+00	1816+00	350 W	243 W	1758	40,000	34.200	51.40	0.525
1644+55 to 1645+50	1810+55 to 1811+50	375 W	268 W	2145	8,880	20.708	103.58	0.077
1648+09 to 1649+61	1814+09 to 1815+61	350 W	243 W	1835	45,000	35.568	51.59	0.521
1642+49 to 1654+09	1808+49 to 1819+60	375 W	268 W	1883	39,000	33.91	55.53	0.427
1644+49 to 1645+53	1810+49 to 1811+53	375 W	268 W	2150	37,000	33.32	64.53	0.280
1649+65 to 1651+17	1815+65 to 1817+17	350 W	243 W	1718	46,000	35.83	47.95	0.635
1646+73 to 1648+01	1812+73 to 1814+01	375 W	268 W	1967	48,000	36.34	54.13	0.456
1651+25 to 1652+45	1817+25 to 1818+45	350 W	243 W	1635	38,000	33.62	48.63	0.613
1656+37 to 1657+45	1821+62 to 1822+62	275 W	267 W	1300	38,000	33.62	38.67	1.140
1653+93 to 1654+65	1819+53 to 1819+85	325 W	230 W	1468	40,000	34.20	42.92	0.870
1654+41 to 1654+69	1819+59 to 1819+84	325 W	237 W	1457	39,000	33.91	42.97	0.860
1652+45 to 1659+21	1818+44 to 1824+37	300 W	258 W	1373	37,000	33.32	41.21	0.960
1650+01 to 1650+69	1816+01 to 1816+69	350 W	243 W	1735	39,000	33.91	51.16	0.530
1652+85 to 1653+89	1818+85 to 1819+48	350 W	238 W	1537	39,000	33.91	45.33	0.740
1655+49 to 1656+33	1820+75 to 1821+53	300 W	260 W	1368	40,000	34.20	40.00	1.040
1659+13 to 1660+01	1824+30 to 1825+13	240 W	320 W	1180	41,000	34.48	34.22	1.580
1650+77 to 1651+73	1816+77 to 1817+73	350 W	243 W	1675	40,000	34.20	48.98	0.600

(Continued)

Note: Calculated maximum acceleration from Canal widening blasts = 1.95 g; mean acceleration = 0.43 g.
* Assumed to be at sta 1831+00, 675 ft east of Canal center line.
** From graph of acceleration versus scaled distance, Figure 12.

Table 4 (Concluded)

Station		Offset (Assumed) ft		Distance to Centroid of La Pita Hill R, ft	Weight W, lb	$W^{1/3}$	Scaled Distance $R/W^{1/3}$	Calculated Acceleration g
Old	Present	Old	Present					
1658+17 to 1659+21	1823+38 to 1824+37	250 W	304 W	1217	36,000	33.02	36.86	1.031
1660+09 to 1660+97	1825+22 to 1827+20	225 W	330 W	1119	34,000	32.38	34.56	1.550
1651+81 to 1652+77	1817+81 to 1818+77	350 W	243 W	1605	40,000	34.20	46.93	0.680
1657+05 to 1658+09	1822+24 to 1823+24	225 W	285 W	1274	40,000	34.20	37.25	1.260
1661+05 to 1662+49	1827+32 to 1828+84	277 W	320 W	1090	40,000	34.20	31.87	1.950
1656+09 to 1656+97	1821+37 to 1822+19	275 W	275 W	1317	35,000	32.71	40.26	1.030
1655+13 to 1656+01	1620+29 to 1621+10	325 W	270 W	1405	40,000	34.20	41.08	0.970
1654+41 to 1655+05	1819+59 to 1820+20	325 W	248 W	1450	33,000	32.08	45.20	0.745
1653+85 to 1654+33	1819+40 to 1819+57	325 W	225 W	1483	34,480	32.55	45.56	0.730
1652+89 to 1653+93	1818+89 to 1819+50	350 W	243 W	1540	38,840	33.87	45.47	0.735
1651+77 to 1652+81	1817+77 to 1818+81	350 W	243 W	1613	39,210	33.97	47.48	0.650
1650+73 to 1651+77	1816+73 to 1817+77	350 W	243 W	1675	36,390	33.14	50.54	0.550
1653+00	1819+00	350 W	243 W	1565	230	6.13	255.30	<0.001
1659+00 to 1661+50	1824+22 to 1827+88	263 W	344 W	1140	7,728	19.38	58.82	0.368
1655+50 to 1656+67	1820+68 to 1821+82	300 W	263 W	1360	1,215	10.67	127.46	0.044
1650+00 to 1652+00	1816+00 to 1818+00	350 W	243 W	1693	9,000	20.80	81.39	0.150
1653+00 to 1656+00	1819+00 to 1821+20	300 W	204 W	1437	6,000	18.17	79.09	0.162
1656+23 to 1657+03	1821+39 to 1822+15	290 W	272 W	1330	20,000	27.14	49.01	0.597
1657+50	1822+66	275 W	285 W	1277	22,000	28.02	45.57	0.732
1655+00 to 1655+50	1820+11 to 1820+64	325 W	260 W	1420	20,000	27.14	52.32	0.492
1654+18 to 1654+50	1819+60 to 1819+69	325 W	230 W	1467	25,000	29.24	50.17	0.562
1654+50	1819+69	325 W	235 W	1455	20,122	27.20	53.49	0.470
1653+50	1819+50	350 W	243 W	1535	20,000	27.14	56.56	0.406
1653+00	1819+00	350 W	243 W	1565	30,000	31.07	50.37	0.555
1652+00	1818+00	350 W	243 W	1625	20,000	27.14	59.87	0.349
1653+00	1819+00	350 W	243 W	1565	20,000	27.14	57.66	0.387
1651+50	1817+50	350 W	243 W	1662	20,000	27.14	61.24	0.328
1650+00	1816+00	350 W	243 W	1756	1,000	10.00	175.60	0.0185
1650+50	1816+50	350 W	243 W	1725	20,000	27.14	63.56	0.298
1650+50	1816+50	350 W	243 W	1725	20,000	27.14	63.56	0.298

Table 5

La Pita Hill Blasts

Date	Blast No.	Station ft	Offset ft	Distance to Centroid R, ft (1831+00 675 ft E)	Weight W, lb	$W^{1/3}$	Scaled Distance $R/W^{1/3}$	Acceleration g
15 Jan 75	1	1822+50 to 1823+50	259–295 W	1248	6175	18.35	68.01	0.24
17 Jan 75	2	1823+50 to 1824+50	264–300 W	1187	5625	17.79	66.72	0.25
22 Jan 75	3	1824+50 to 1825+50	262–307 W	1135	5850	18.02	62.99	0.27
24 Jan 75	4	1825+50 to 1826+50	275–320 W	1097	6225	18.40	59.62	0.35
28 Jan 75	5	1826+50 to 1827+50	285–330 W	1065	7033	19.16	55.58	0.43
30 Jan 75	6	1827+50 to 1828+50	285–330 W	1032	5658	17.82	57.91	0.37
3 Feb 75	7	1828+50 to 1829+50	303 W	1000	5000	17.10	58.48	0.37
5 Feb 75	8	1829+50 to 1830+50	285–330 W	987	3600	15.33	64.38	0.28
	9	NO DATA AVAILABLE						
11 Feb 75	10	1831+50 to 1832+50	285–330 W	986	3575	15.29	64.49	0.28
13 Feb 75	11	1832+50 to 1833+50	285–330 W	1003	4950	17.03	58.90	0.35
14 Feb 75	12	1833+50 to 1834+50	285–330 W	1030	4167	16.09	64.01	0.29
18 Feb 75	13	1834+50 to 1835+50	312–330 W	1075	2200	13.01	82.63	0.14
19 Feb 75	14	1834+50 to 1835+50	285–303 W	1052	1867	12.31	85.46	0.13
20 Feb 75	15	1835+50 to 1836+50	295–313 W	1103	2208	13.02	84.72	0.14
21 Feb 75	16	1835+50 to 1836+50	268–286 W	1078	2009	12.62	85.42	0.13
24 Feb 75	17	1836+50 to 1837+50	250–268 W	1110	2642	13.82	80.32	0.15
25 Feb 75	18	1836+50 to 1837+50	277–295 W	1135	1800	12.16	93.34	0.10
26 Feb 75	19	1837+50 to 1838+50	245–263 W	1163	2400	13.39	86.86	0.12

Note: Maximum acceleration = 0.43 g; mean acceleration = 0.24 g.

Table 6

Summary of Laboratory Strength Test Results for the Las

Location	Boring No.	Sample No.	Depth ft	Description	Atterberg Limits			Grain Size <2 μ %	Activity Ratio	G_s	Initial Laboratory Test Results				
					LL	PL	PI				Water Content %	Dry Density pcf	Void Ratio	Saturation %	
											South Atlantic Division Laboratory, 196				
Route 14, Panama	D-1	2	81.7-82.9	Green volcanic agglomerate slakes to MH	60	33	27	13	2.1	2.64	11.2	148	--	--	UC
		4	101.0-102.5	White tuff slakes to MH	84	46	38	15	2.5	2.63	12.3	142	--	--	UC
		10	174.9-176.0	Agglomerate	--	--	--	--	--	2.66	7.1	155	--	--	UC
		13	230.4-231.6	Agglomerate	--	--	--	--	--	2.77	11.0	147	--	--	UC
		15	235.5-236.0	Red shale slakes to SM (considered a clay shale)	37	34	3	3	1.5	2.80	18.7	111.4	0.569	91.7	Multistage 2 in. by δ_{max} = 1
		16	237.8-240.0	Dark brown shale slakes to CH (considered a clay shale)	50†† 78‡ 93‡‡	39†† 31‡ 35‡‡	11†† 47‡ 58‡‡	2†† 27‡ 41‡‡	5.5 1.7 1.4	2.82	14.8 16.3 16.1 14.9	117.1 112.5 109.9 110.4	0.503 0.564 0.601 0.594	83.3 81.3 75.6 70.8	DDS on und by 2 in. min, δ_p
											14.3 14.5 15.1	125.5 125.1 124.3	0.403 0.407 0.413	100.0 100.0 100.0	RDDS on un 2 in. by δ_{max} = 1
											Waterways Experiment Station, 1975 (This R				
La Pita Hill	ERE-25A	6	125.0-127.0	Agglomerate, OH-5 to RH-3	102§§	22§§	80§§	--	--	--	22.4 18.3 17.5	107.4 111.3 113.8	-- -- --	-- -- --	UDS on und imately at 0.002
	ERE-25A	8	165.8-168.3	Tuff, RH-3 to RH-1	97§§	39§§	58§§	--	--	--	24.1 24.6 25.4	104.5 104.6 102.5	-- -- --	-- -- --	UDS on und imately at 0.002
	ERE-25A	9	169.0-171.2	Tuff, RH-3 to RH-1	82§§	34§§	48§§	--	--	--	23.4 23.5 24.5	101.6 101.6 101.2	-- -- --	-- -- --	DDS on und 3 in. by min, δ_m
	ERE-25A	11A	212.0-213.1	Tuff, RH-1 to RH-2	98§§	40§§	58§§	--	--	--	15.7 16.5 16.3	120.3 119.8 119.4	-- -- --	-- -- --	UDS on und imately at 0.002
	ERE-25A	11B	213.1-214.1	Tuff, RH-1 to RH-2	82§§	30§§	52§§	--	--	--	--	--	--	--	None
	ERE-26	3	'164.6-165.3	Tuff, RH-1 to RH-2	78§§	38§§	40§§	--	--	--	16.2 16.7	118.7 114.5	-- --	-- --	UDS on und imately at 0.002
	ERE-27#	6	135.5-136.3	Tuff, RH-2 to RH-3	76§§	36§§	40§§	--	--	--	22.1	107.3	--	--	
	ERE-26	5	209.8-210.3	Tuff (fault zone), RH-2 to RH-3	--	--	--	--	--	--	21.6	99.7	--	--	Multistage approxim in. high 0.42 in.
	ERE-26	6	236.7-237.9	Andesite, RH-3 to RH-5	--	--	--	--	--	--	11.7 11.4 12.1	129.0 128.4 128.8	-- -- --	-- -- --	UDS on und imately high, at in.
	ERE-27	4	74.5-75.6	Tuff, OH-3 to RH-2	98§§	43§§	55§§	--	--	--	39.1 38.9 42.1	78.3 79.5 77.5			RDDS on un by 3 in. min, δ_m
	ERE-27	7	141.4-142.5	Tuff, RH-2 to RH-3	99§§	57§§	42§§	--	--	--	29.3 88.6 27.2	95.0 96.1 96.9	-- -- --	-- -- --	UDS on und imately high, at in.

Note: s_u = undrained shear strength; σ'_n = effective normal stress; σ_n = total normal stress; τ_p = peak shear strength; τ_u = ultimate shear strength; τ_r = c_p = total peak cohesion intercept; $\emptyset_p$ = total peak angle of internal friction; c' = effective "ultimate" cohesion intercept; $\emptyset'_u$ = effective "ulti
   * UC = unconfined compression test; RDDS = repeated drained direct shear test; δ_{max} = maximum displacement; DDS = drained shear test; δ_p = displaceme
  ** "Ultimate" = strength at displacement of about 0.3 in.
   † U. S. Army Engineer Division, South Atlantic, 1968.
  †† 3 cycles of slaking 2 min in blender.
   ‡ 9 cycles of slaking 2 min in blender.
  ‡‡ 19 cycles of slaking 4 min in blender.
   § Minimum value.
  §§ Air dried and soaked 48 hr each, then blenderized 10 min, Banks et al., 1975 (Appendix B).
   # Sample added due to insufficient material in boring No. ERE-26, sample No. 3, to perform complete test.

Table 6

Results for the Las Cascadas Formation

Satura-tion %	Type of Test*	s_u tsf	Normal Stress σ'_n tsf	Normal Stress σ_n tsf	Shear Stress τ_p tsf	Shear Stress τ_u tsf	Shear Stress τ_r tsf	Peak c'_p tsf	Peak ϕ'_p deg	Peak c_p tsf	Peak ϕ_p tsf	Ultimate** c'_u tsf	Ultimate** ϕ'_u deg	Ultimate** c_u tsf	Ultimate** ϕ_u tsf	Residual c'_r tsf	Residual ϕ'_r deg

ry Test — Shear Strength Data

ision Laboratory, 1968†

Satura-tion %	Type of Test*	s_u tsf	σ'_n tsf	σ_n tsf	τ_p tsf	τ_u tsf	τ_r tsf	c'_p tsf	ϕ'_p deg	c_p tsf	ϕ_p tsf	c'_u tsf	ϕ'_u deg	c_u tsf	ϕ_u tsf	c'_r tsf	ϕ'_r deg
--	UC	30	--		--	--	--	--	--	--	--	--	--	--	--	--	--
--	UC	50	--		--	--	--	--	--	--	--	--	--	--	--	--	--
--	UC	57	--		--	--	--	--	--	--	--	--	--	--	--	--	--
--	UC	13	--		--	--	--	--	--	--	--	--	--	--	--	--	--
91.7	Multistage RDDS remolded specimen, 2 in. by 2 in. by 0.5 in., precut, δ_{max} = 10 in.	--	4 8 12		-- -- --	-- -- --	0.57 0.80 1.10	--	--	--	--	--	--	--	--	0.2	4.5
83.3 81.3 75.6 70.8	DDS on undisturbed specimens, 2 in. by 2 in. by 0.57 in. at 0.001 in./min, δ_p = 0.03-0.2 in.	--	9 10 12 18		12.5 13.3 13.2 16.6	5.54 6.98 8.35 13.10	-- -- -- --	7.9 -- -- --	24.5 -- -- --	--	--	0.0	34.0	--	--	--	--
100.0 100.0 100.0	RDDS on undisturbed precut specimens, 2 in. by 2 in. by 0.5 in., δ_{max} = 10 in.	--	4 8 12		2.97 3.49 5.65	-- -- --	1.62§ 2.70§ 3.82§	1.8 -- --	15.5 -- --	--	--	--	--	--	--	0.5 (Minimum values)	11.5

Station, 1975 (This Report)

Satura-tion %	Type of Test*	s_u tsf	σ'_n tsf	σ_n tsf	τ_p tsf	τ_u tsf	τ_r tsf	c'_p tsf	ϕ'_p deg	c_p tsf	ϕ_p tsf	c'_u tsf	ϕ'_u deg	c_u tsf	ϕ_u tsf	c'_r tsf	ϕ'_r deg
-- -- --	UDS on undisturbed specimens, approximately 5-in. diam. by 4.8 in. high, at 0.002 in./min, δ_{max} = 0.42 in.	-- -- --		4 8 12	7.65 16.87 26.67	4.92 8.71 9.47	-- -- --	--	--	0.0	65.2	--	--	2.1	39.8	--	--
-- -- --	UDS on undisturbed specimens, approximately 5-in. diam. by 4.8 in. high, at 0.002 in./min, δ_{max} = 0.42 in.	-- -- --		4 8 12	13.08 17.27 22.16	4.12 7.09 5.19	-- -- --	--	--	8.7	48.3	--	--	3.6	7.6	--	--
-- -- --	DDS on undisturbed specimens, 3 in. by 3 in. by 1.0 in. at 0.00008 in./min, δ_{max} = 0.5 in.	--	4 8 12	-- -- --	6.72 6.62 9.70	2.82 2.82 5.57	-- -- --	0.4	38.0	--	--	0.0	25.0	--	--	--	--
-- -- --	UDS on undisturbed specimens, approximately 5-in. diam. by 4.8 in. high, at 0.002 in./min, δ_{max} = 0.42 in.	--	-- -- --	4 8 12	12.32 16.06 25.67	4.29 6.50 10.23	-- -- --	--	--	8.5	44.3	--	--	2.1	28.6	--	--
--	None	--	--		--	--	--	--	--	--	--	--	--	--	--	--	--
-- -- --	UDS on undisturbed specimens, approximately 4-in. diam. by 4.8-in. high, at 0.002 in./min, δ_{max} = 0.42 in.	-- -- --	-- -- --	4 8 12	18.33 21.19 22.13	2.55 5.49 7.24	-- -- --	--	--	15.4	36.3	--	--	2.0	23.5	--	--
--	Multistage UDS on a faulted specimen, approximately 3.9-in. diam. by 4.8 in. high, at 0.002 in./min, δ_{max} = 0.42 in.	--	--	4 8 12	3.84 3.90 6.21	3.64 3.90 6.21	-- -- --	--	--	2.6	16.5	--	--	2.6	16.5	--	--
-- -- --	UDS on undisturbed specimens, approximately 3.9-in. diam. by 4.8-in. high, at 0.002 in./min, δ_{max} = 0.42 in.			4 8 12	22.05 16.28 24.45	2.53 6.55 9.10	-- -- --	--	--	0.3	63.8	--	--	1.7	31.5	--	--
--	RDDS on undisturbed specimens, 3 in. by 3 in. by 1.0 in. at 0.03125 in./min, δ_{max} = 0.25 in.	4 8 12		-- -- --	-- -- --	-- -- --	0.70 1.28 1.76	--	--	--	--	--	--	--	--	0.0	8.29
-- -- --	UDS on undisturbed specimens, approximately 3.8-in. diam by 4.8-in. high, at 0.002 in./min, δ_{max} = 0.42 in.			4 8 12	4.40 14.48 16.60	2.30 3.42 4.23	-- -- --	--	--	10.3	28.0	--	--	1.4	13.8	--	--

shear strength; τ_r = residual shear strength; c'_p = effective peak cohesion intercept; ϕ'_p = effective peak angle of internal friction;
ϕ'_u = effective "ultimate" angle of internal friction; c_u = total "ultimate" cohesion intercept ϕ_u = total "ultimate" angle of internal friction.
test; δ_p = displacement at peak shear stress; UDS = undrained direct shear test performed in a rock shear device.
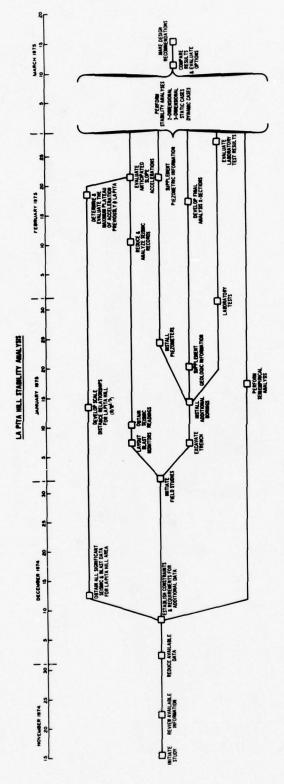
Figure 1. Critical path program of La Pita Hill stability evaluation. (The time frame indicated was ex-
tended due to a relaxation of the blasting schedule by PCC).
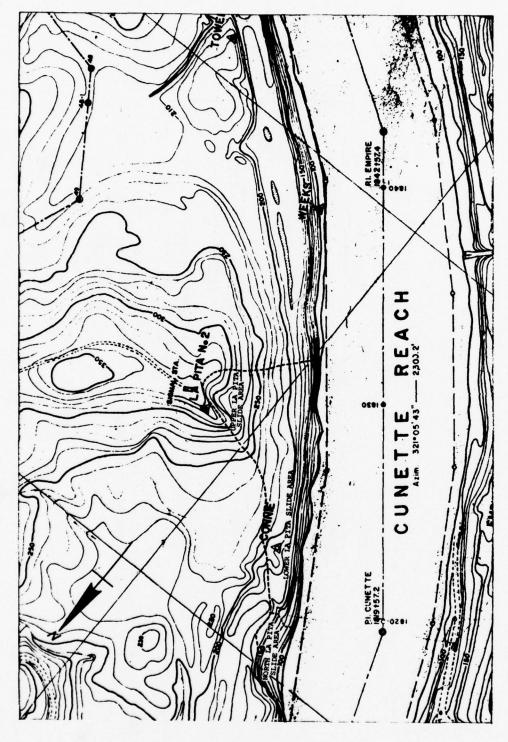
Figure 2. General plan map of La Pita Hill area showing location of previous slides
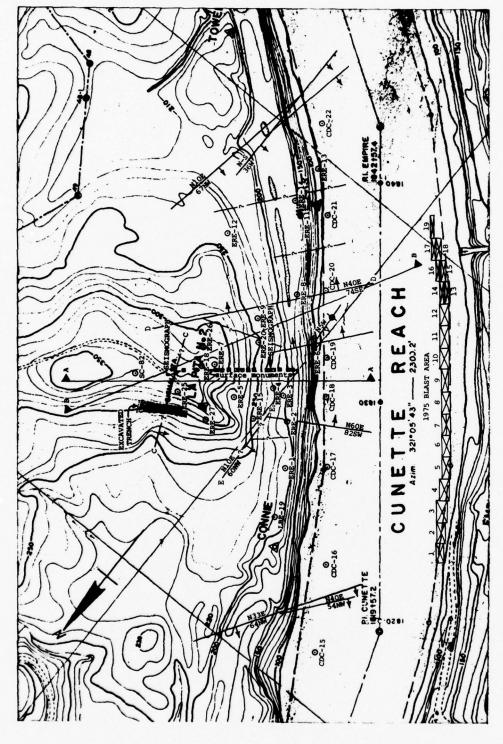
Figure 3. Plan map showing locations of borings, faults, trenches, surface monuments, and seismographs
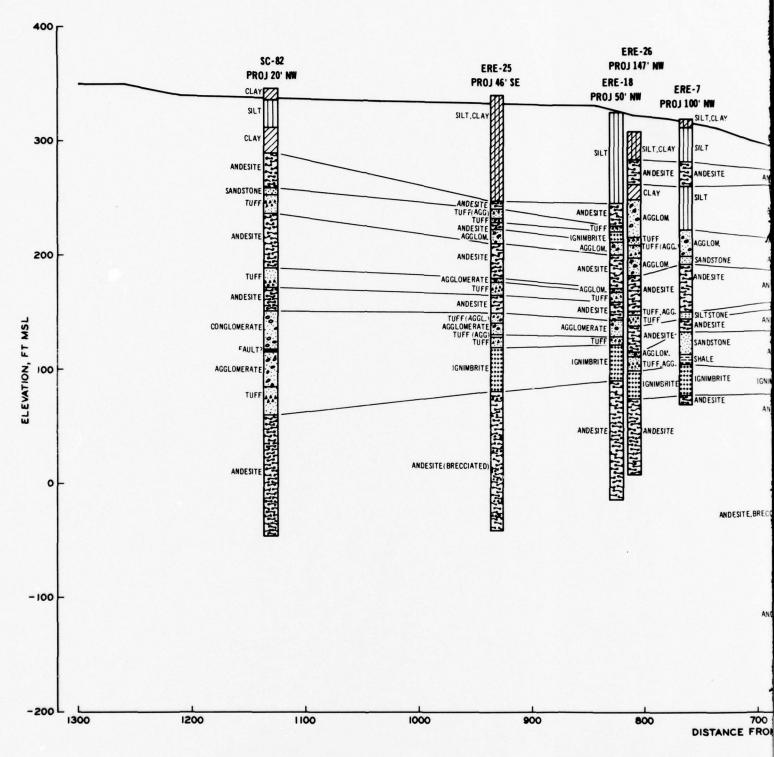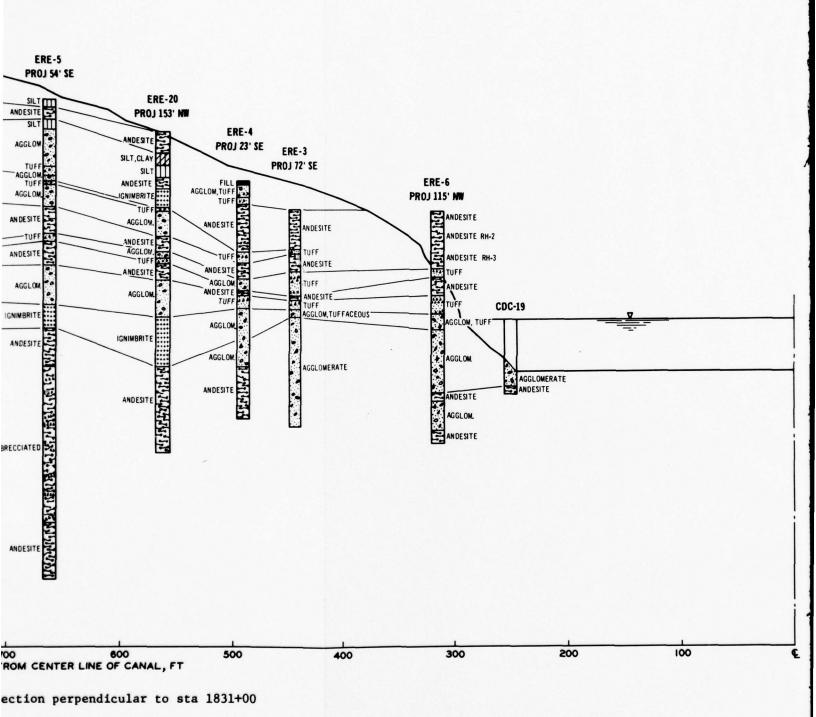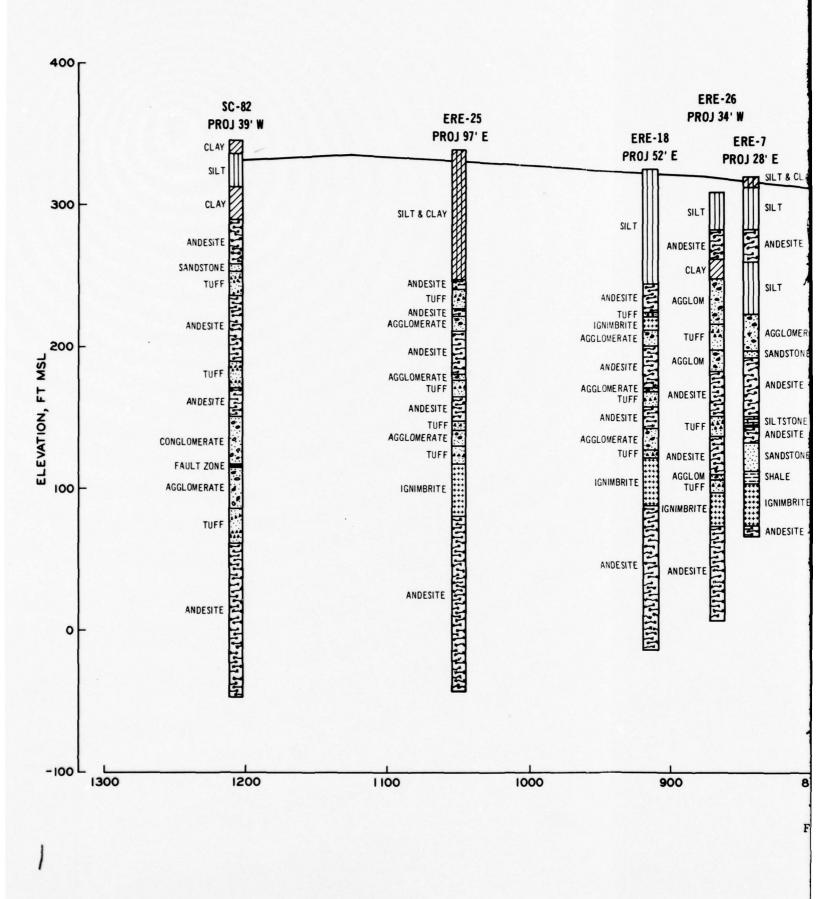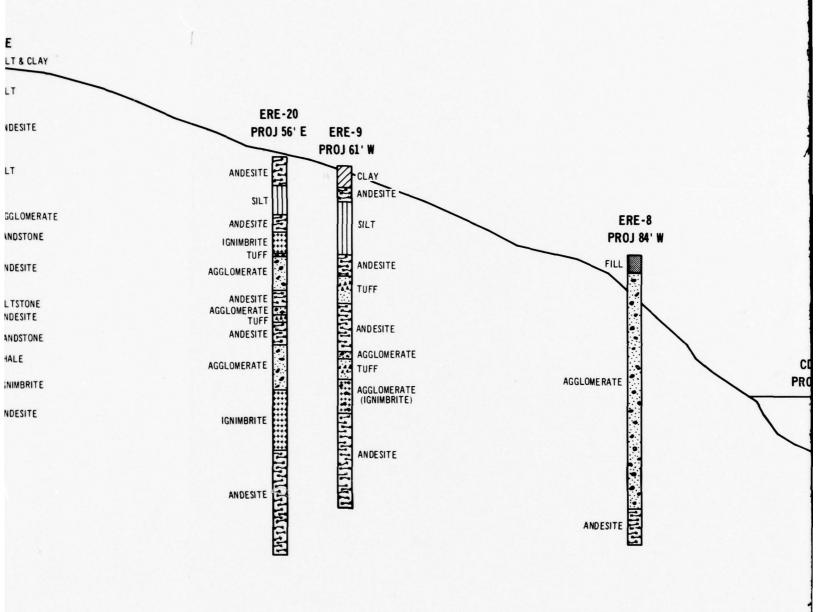
Figure 4. Geologic cross sect

ERE-5
PROJ 54' SE

SILT
ANDESITE
SILT
AGGLOM
TUFF
AGGLOM
TUFF
AGGLOM
ANDESITE
TUFF
ANDESITE
AGGLOM
IGNIMBRITE
ANDESITE
BRECCIATED
ANDESITE

ERE-20
PROJ 153' NW

ANDESITE
SILT,CLAY
SILT
ANDESITE
IGNIMBRITE
TUFF
AGGLOM.
ANDESITE
AGGLOM.
TUFF
ANDESITE
AGGLOM.
IGNIMBRITE
ANDESITE

ERE-4
PROJ 23' SE

FILL
AGGLOM,TUFF
TUFF
ANDESITE
TUFF
ANDESITE
AGGLOM
ANDESITE
TUFF
AGGLOM.
AGGLOM.
ANDESITE

ERE-3
PROJ 72' SE

ANDESITE
TUFF
ANDESITE
TUFF
ANDESITE
TUFF
AGGLOM,TUFFACEOUS
AGGLOMERATE

ERE-6
PROJ 115' NW

ANDESITE
ANDESITE RH-2
ANDESITE RH-3
TUFF
ANDESITE
TUFF
AGGLOM, TUFF
AGGLOM.
ANDESITE
AGGLOM.
ANDESITE

CDC-19

AGGLOMERATE
ANDESITE

700   600   500   400   300   200   100   ₵

FROM CENTER LINE OF CANAL, FT

ection perpendicular to sta 1831+00

2

E

LT & CLAY

LT

NDESITE

LT

GGLOMERATE

ANDSTONE

NDESITE

LTSTONE
NDESITE

ANDSTONE

HALE

GNIMBRITE

NDESITE

ERE-20
PROJ 56' E

ERE-9
PROJ 61' W

ANDESITE

SILT

ANDESITE

IGNIMBRITE
TUFF

AGGLOMERATE

ANDESITE
AGGLOMERATE
TUFF
ANDESITE

AGGLOMERATE

IGNIMBRITE

ANDESITE

CLAY

ANDESITE

SILT

ANDESITE

TUFF

ANDESITE

AGGLOMERATE
TUFF

AGGLOMERATE
(IGNIMBRITE)

ANDESITE

ERE-8
PROJ 84' W

FILL

AGGLOMERATE

ANDESITE

CD
PRO

800   **700**   **600**   **500**   **400**   **300**

DISTANCE FROM CENTER LINE OF CANAL, FT

Figure 5. Oblique cross section through sta 1835+50

2

CDC-20
PROJ 50' W

IGNIMBRITE

AGGLOMERATE

300   200   100   ℄

3

Figure 6. Simpl:

Simplified geologic cross section perpendicular to sta 1831+00

c = 5400
ϕ = 29.9

300   200   100   ℄

3
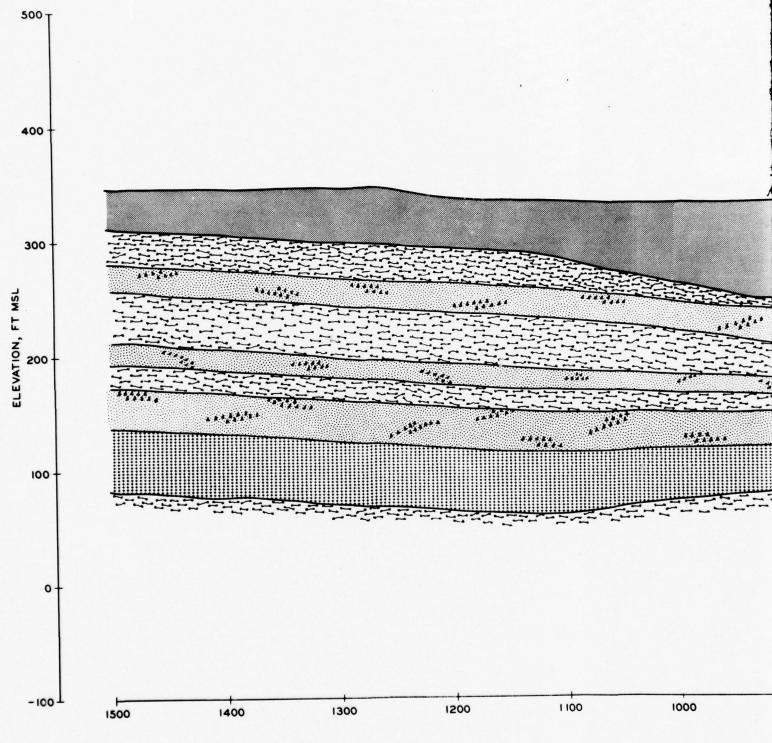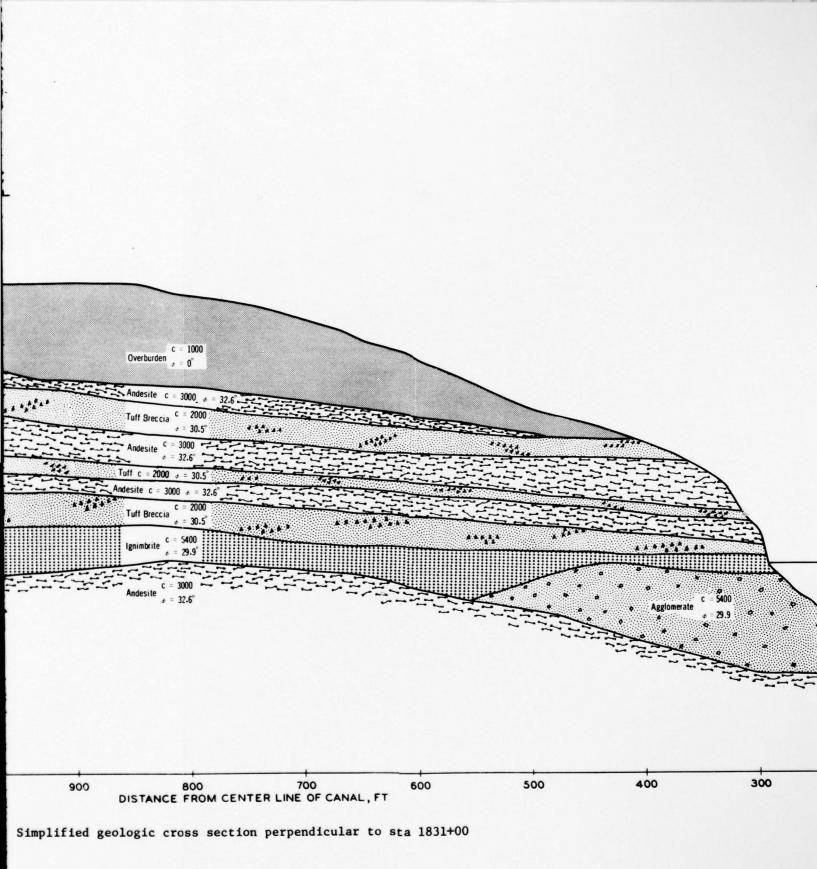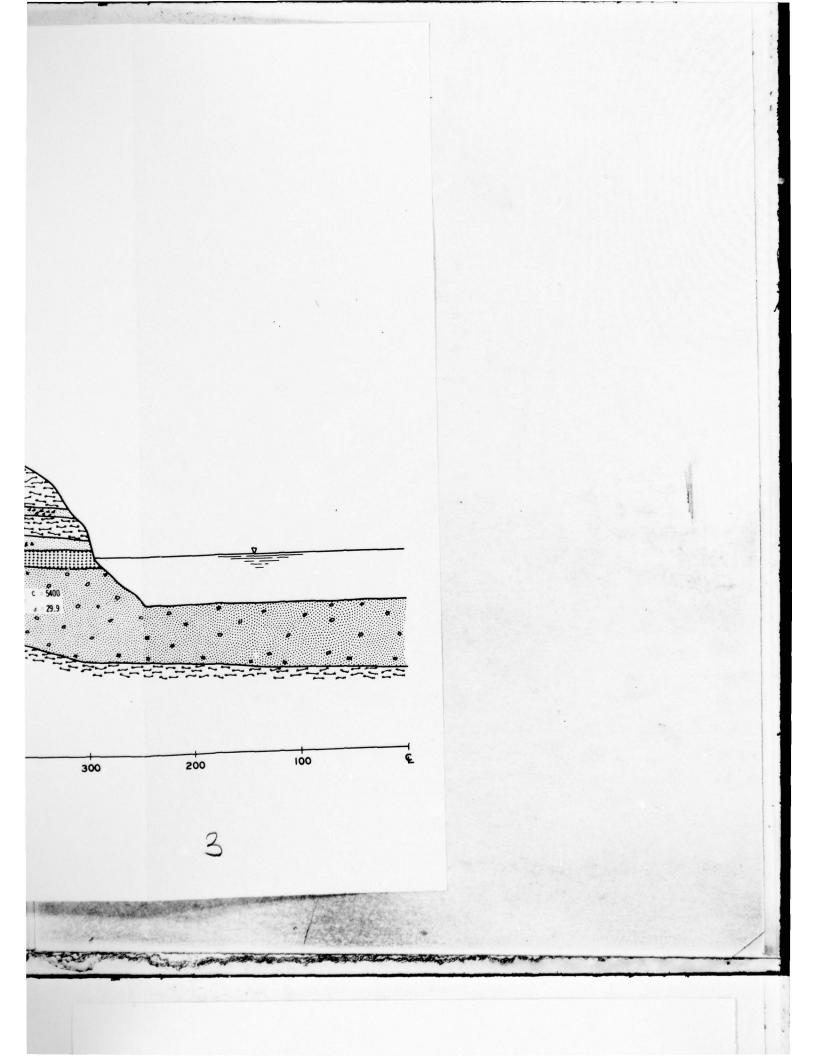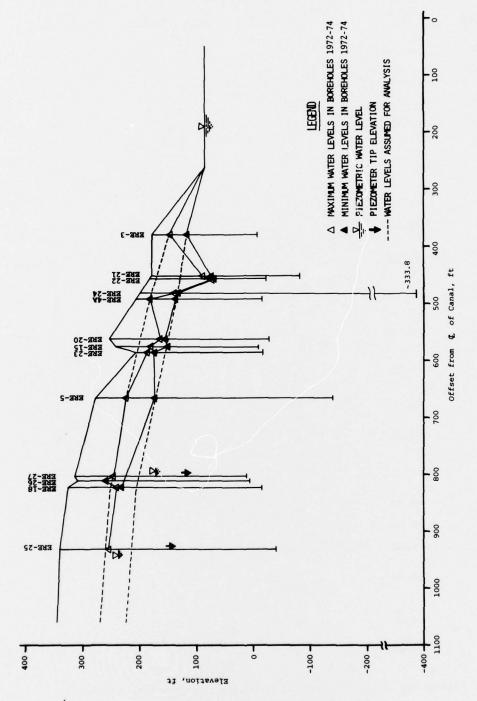
Figure 7. Projected section with maximum and minimum water levels, piezometric water levels, and water levels assumed for analysis

Monument	Initial Offset from ₵ ft	Movement History				Net Horizontal Movement (ft E or W)
		from 05/06/70	to 05/30/73	from 05/30/73	to 05/24/74	
0	900.00E	·		·		⊙ 0
1	840.0E	·		↑		◐ 0.02E
2	754.37E	↓		↑		○ 0.12W
3	724.33E	↓		↑		○ 0.10W
4	694.70E	↓		↑		○ 0.17W
5	666.13E	↓		↑		⊙ 1.44W
6	632.81E	↓		↑		○ 0.14W
7	603.69	↓ ·		↓		○ 0.05W
8	577.94E	↓		·		○ 0.03W
9	521.78E	↓		·		○ 0.02W
10	563.76E	↓ ·		·		○ 0.01W
11	485.01E	·		·		⊙ 0
12	458.80E	·		·		⊙ 0
13	421.67E	·		·		○ 0.01W
14	399.78E	↓		·		○ 0.03W

Figure 8. Total horizontal movement and movement history
for monuments at sta 1831+50
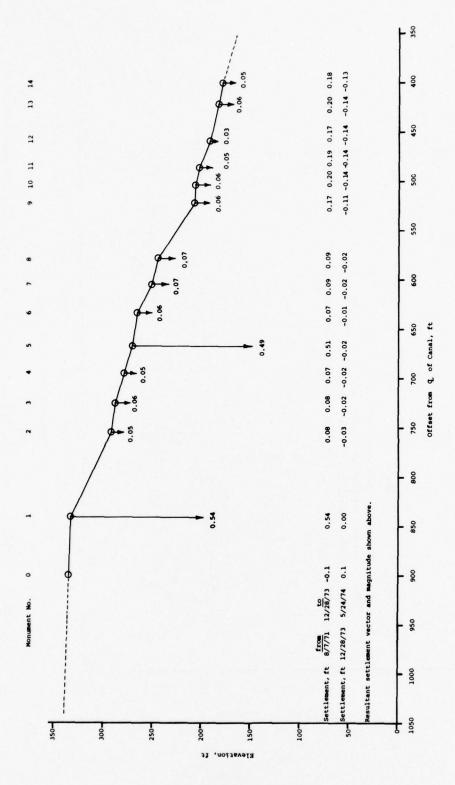
Figure 9. Total settlement and settlement history for monuments at sta 1831+50
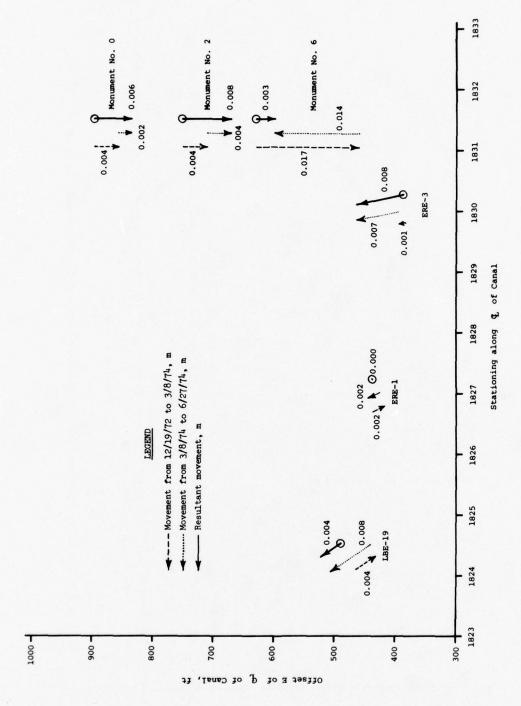
Figure 10. Plan showing movement history and resultant movements for EDM measurements
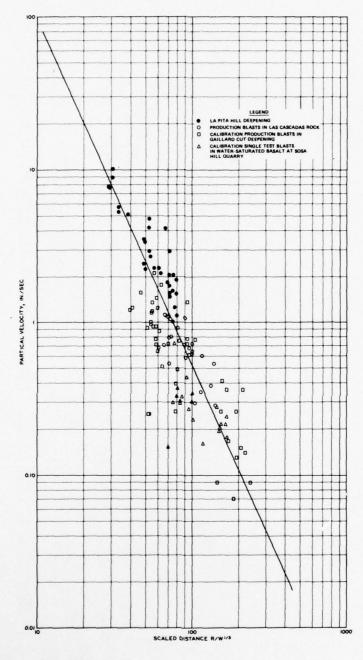
Figure 11. Resultant particle velocity versus
scaled distance obtained from blast data
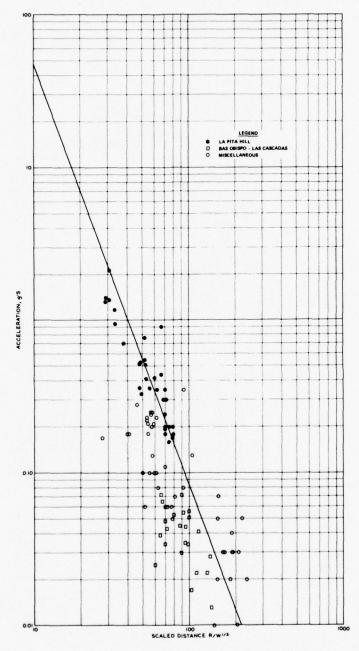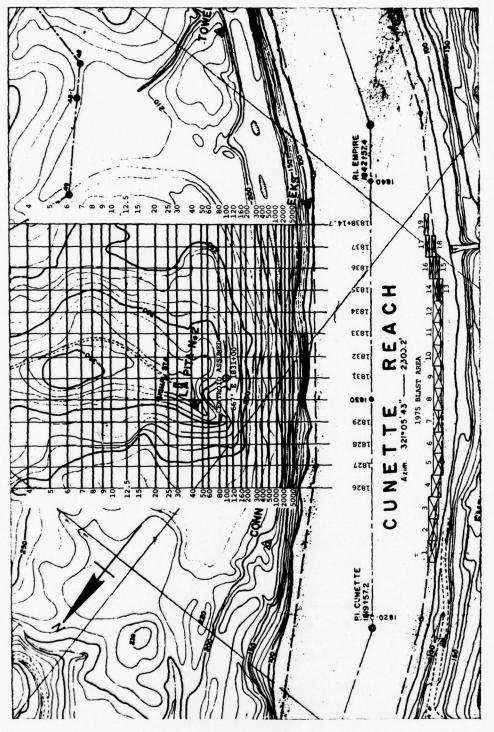
Figure 12. Resultant acceleration versus scaled
distance obtained from blast area

Figure 13. Plan map showing acceleration contours used for analysis (contours represent percentages of acceleration occurring at an assumed centroid)

Figure 14. Peak shear stress versus normal stress for
single-plane direct shear tests
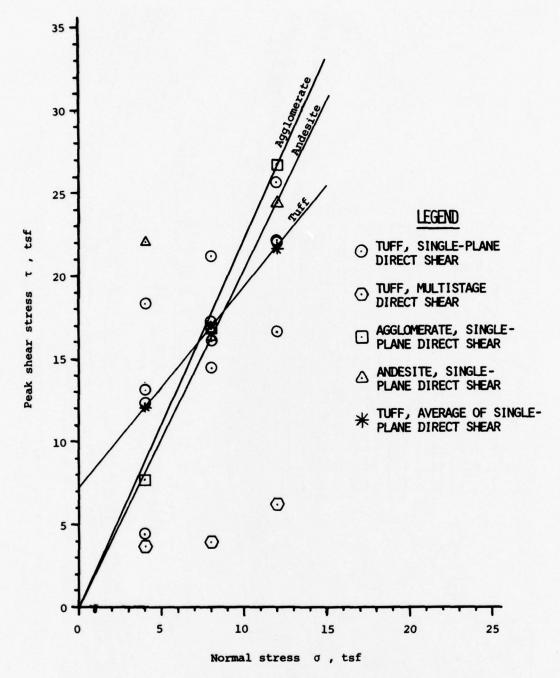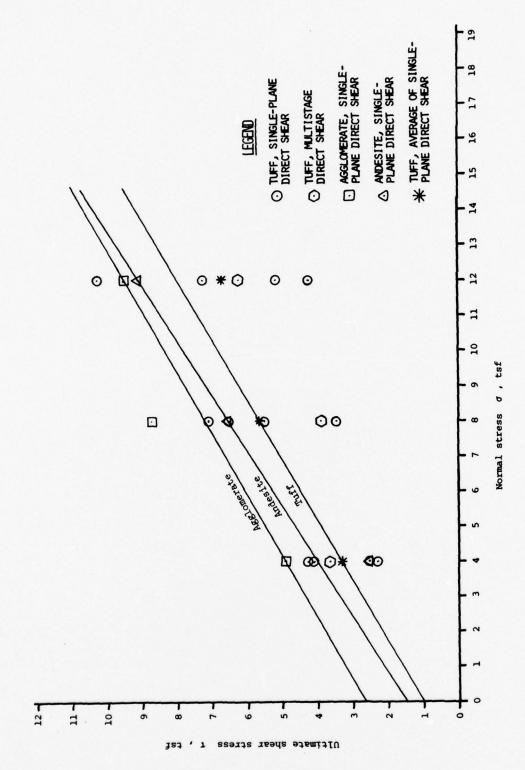
Figure 15. Ultimate shear stress versus normal stress for undrained direct shear tests
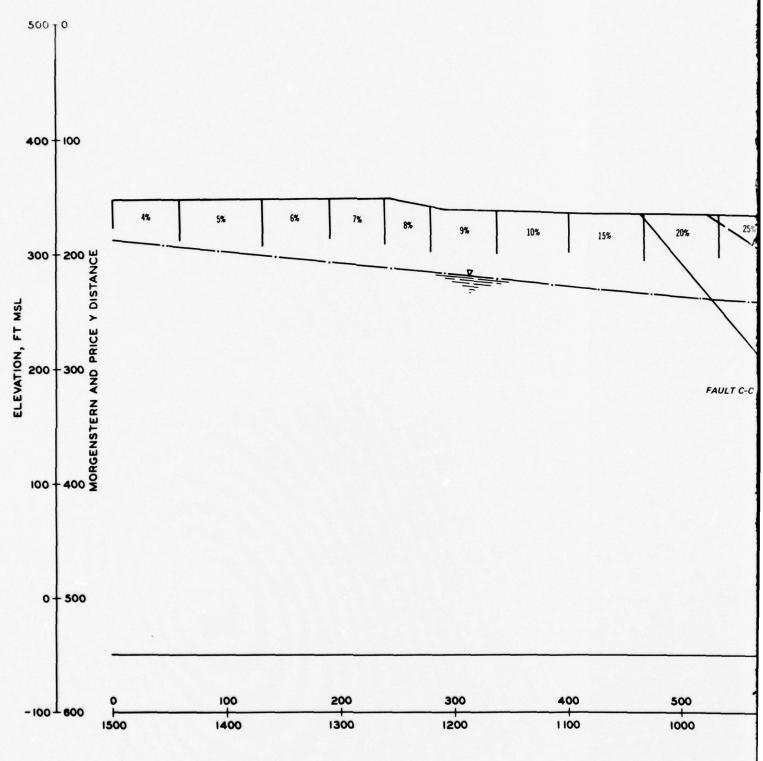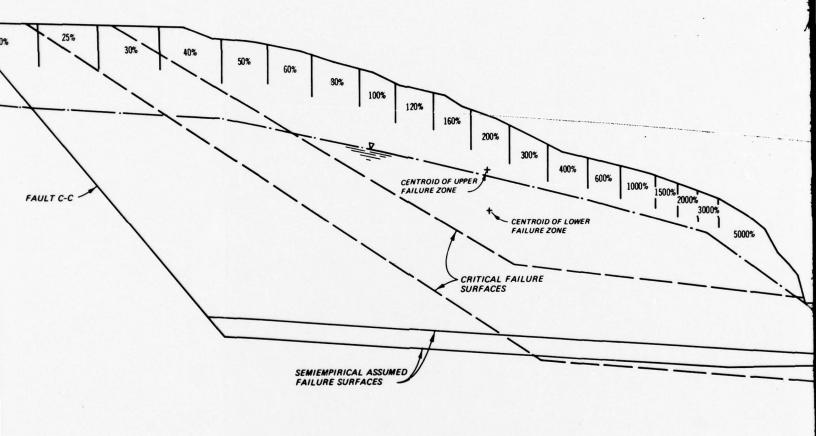
Figure 16. Semiempirical
in

FAULT C-C

CENTROID OF UPPER
FAILURE ZONE

CENTROID OF LOWER
FAILURE ZONE

CRITICAL FAILURE
SURFACES

SEMIEMPIRICAL ASSUMED
FAILURE SURFACES
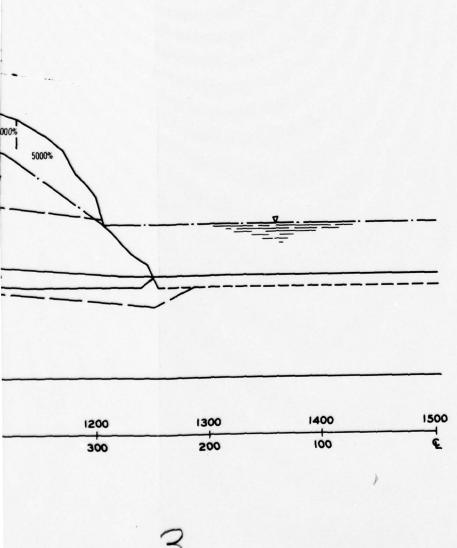
MORGENSTERN AND PRICE X DISTANCE

DISTANCE FROM CENTER LINE OF CANAL, FT

Semiempirical analysis cross section shown with acceleration distribution utilized
in conventional analysis with distributed accelerations

000%

5000%

1200   1300   1400   1500

300   200   100   C

3
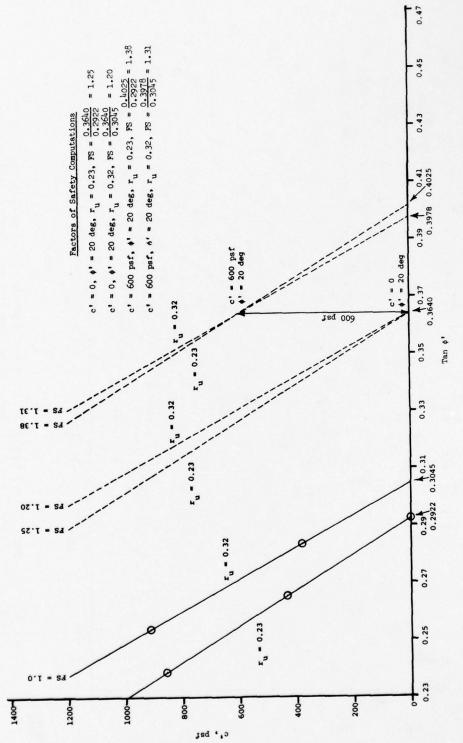
Figure 17. Strength curves used with semiempirical analysis to compute factors of safety prior to deepening for limiting pore pressure and strength assumptions
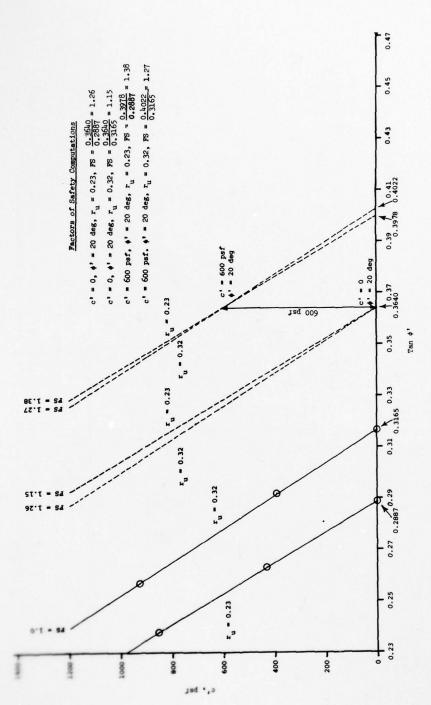
Figure 18. Strength curves used with semiempirical analysis to compute factors of safety after deepening for limiting pore pressure and strength assumptions
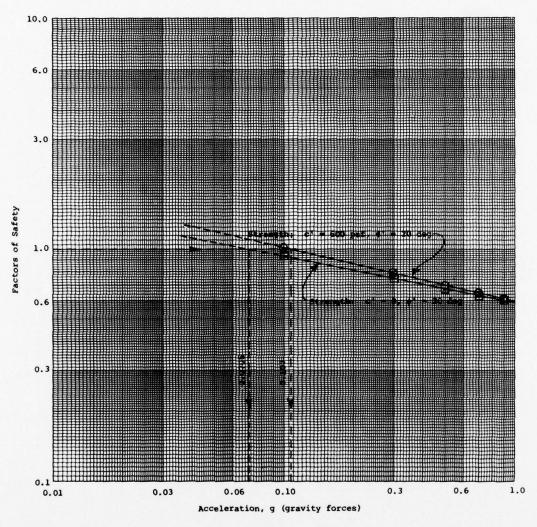
Figure 19. Factors of safety versus acceleration for semiempirical
stability analysis using uniformly applied accelerations
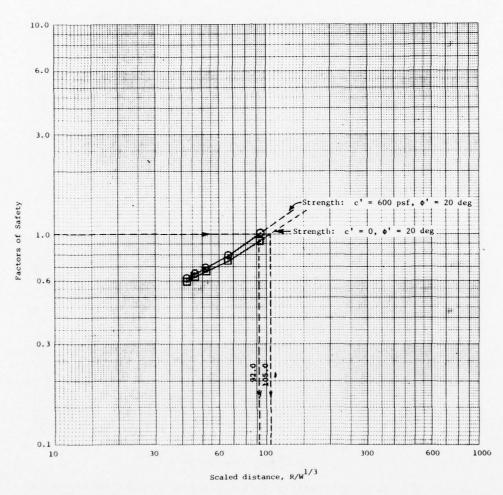
Figure 20. Factors of safety versus scaled distance for semiempirical
stability analysis using uniformly applied accelerations
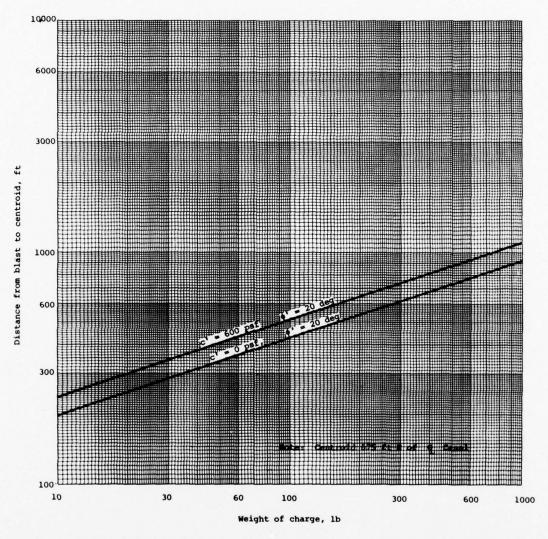
Figure 21. Relationship between distance from blast and weight of charge to maintain factor of safety of 1.0 for semiempirical analysis using uniformly applied accelerations
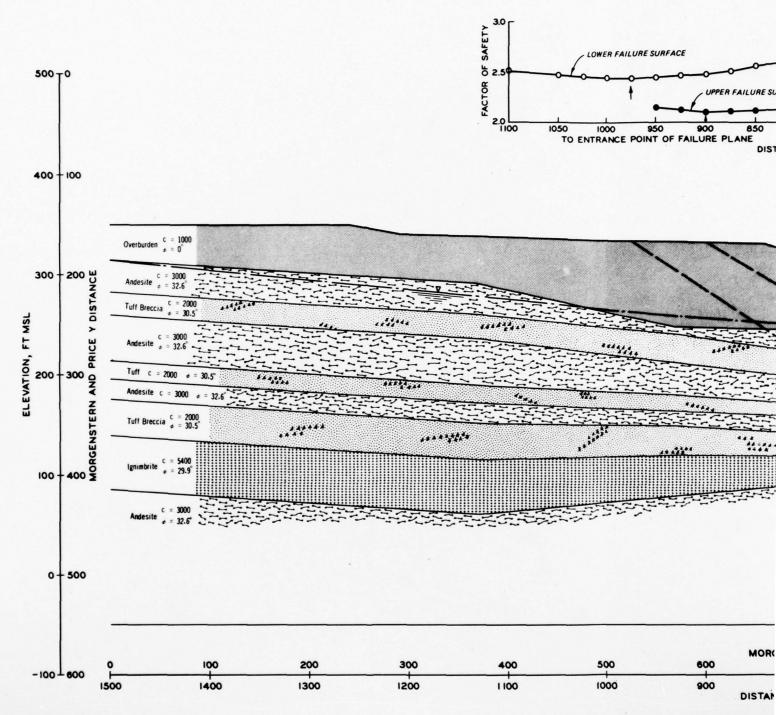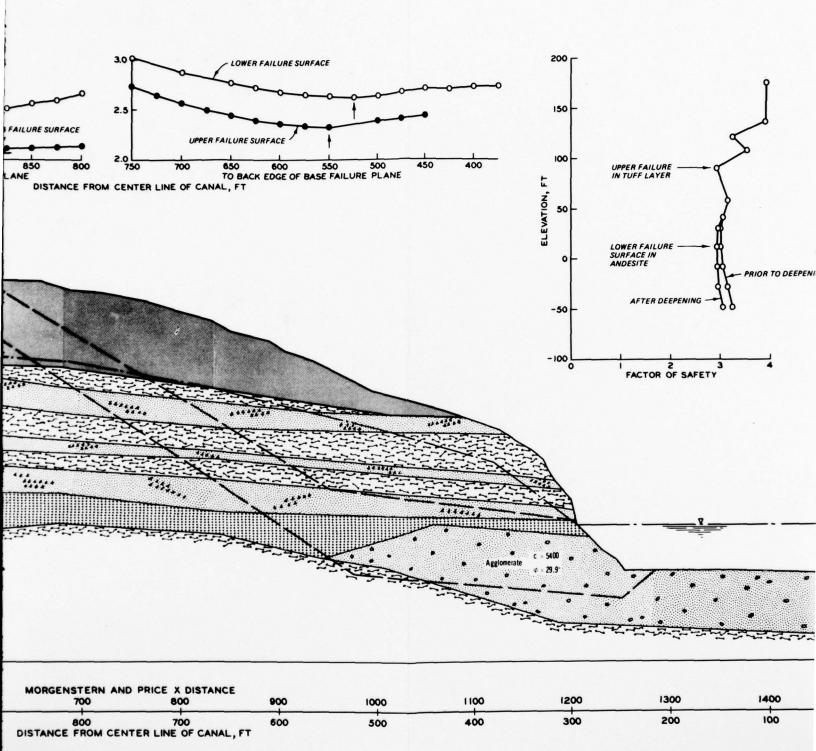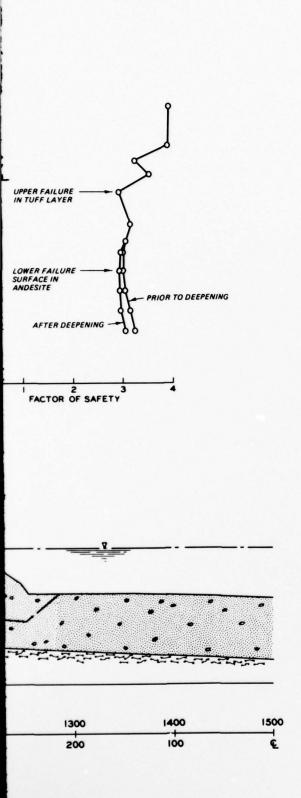
Figure 22. Conventional analysis
of the Morgenst[...]

LOWER FAILURE SURFACE

UPPER FAILURE SURFACE

3.0

2.5

2.0

750   700   650   600   550   500   450   400

TO BACK EDGE OF BASE FAILURE PLANE

DISTANCE FROM CENTER LINE OF CANAL, FT

FAILURE SURFACE

850   800

LANE

200

150

100

50

0

-50

-100

ELEVATION, FT

UPPER FAILURE
IN TUFF LAYER

LOWER FAILURE
SURFACE IN
ANDESITE

PRIOR TO DEEPENI

AFTER DEEPENING

0   1   2   3   4

FACTOR OF SAFETY

Agglomerate   c = 5400
ϕ = 29.9°

MORGENSTERN AND PRICE X DISTANCE

700   800   900   1000   1100   1200   1300   1400

800   700   600   500   400   300   200   100

DISTANCE FROM CENTER LINE OF CANAL, FT

nalysis cross section utilized with the WES version
orgenstern and Price computer program

UPPER FAILURE
IN TUFF LAYER →

LOWER FAILURE
SURFACE IN
ANDESITE →

← PRIOR TO DEEPENING

AFTER DEEPENING →

1   2   3   4

FACTOR OF SAFETY

1300   1400   1500

200   100   ₵

3
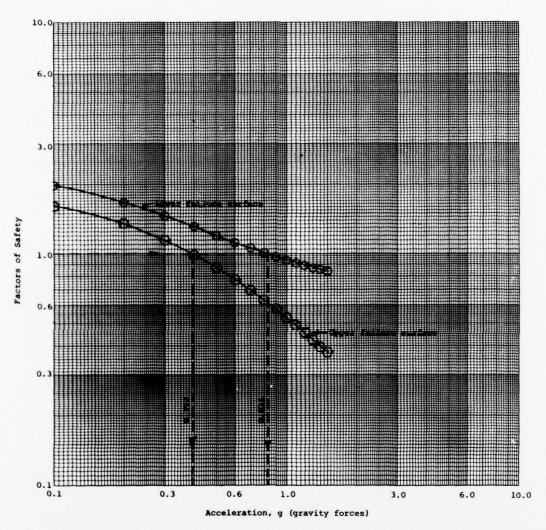
Figure 23. Factors of safety versus acceleration for conventional
stability analysis using uniformly applied accelerations
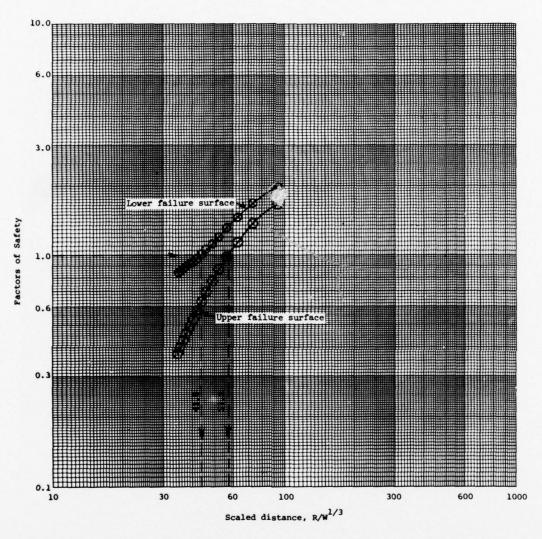
Figure 24. Factors of safety versus scaled distance for conventional stability analysis using uniformly applied accelerations
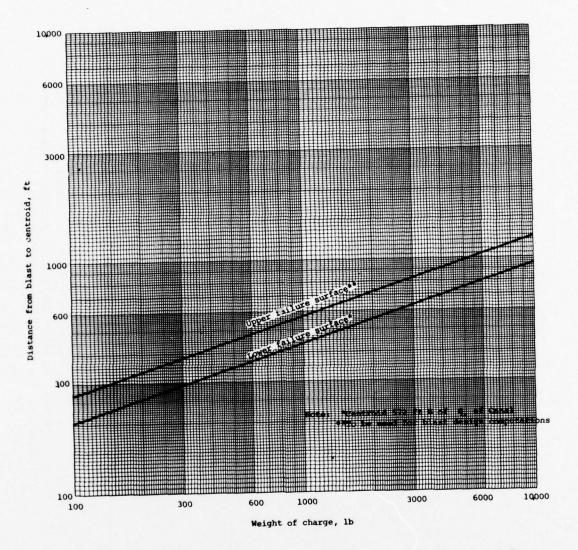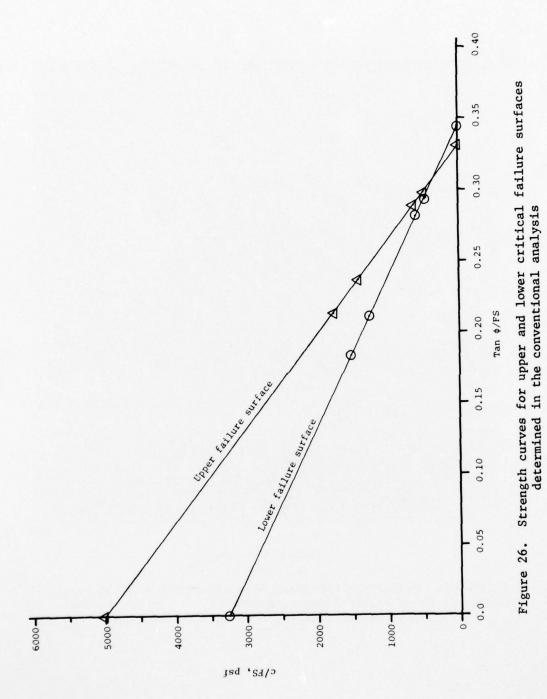
Figure 25. Relationship between distance from blast and weight
of charge to maintain factor of safety of 1.0 for conventional
analysis using uniformly applied accelerations

Figure 26. Strength curves for upper and lower critical failure surfaces determined in the conventional analysis
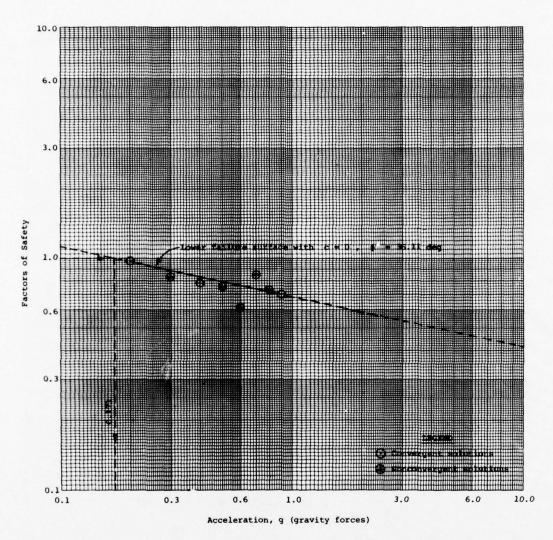
Figure 27. Factors of safety versus acceleration for conventional
stability analysis using distributed accelerations
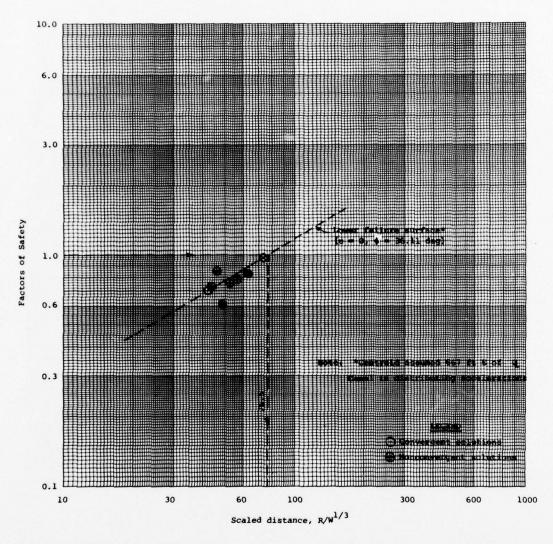
Figure 28. Factor of safety versus scaled distance for conventional
stability analysis using distributed accelerations
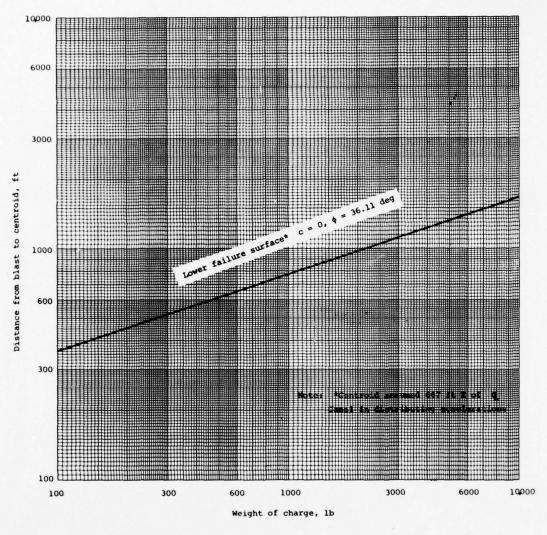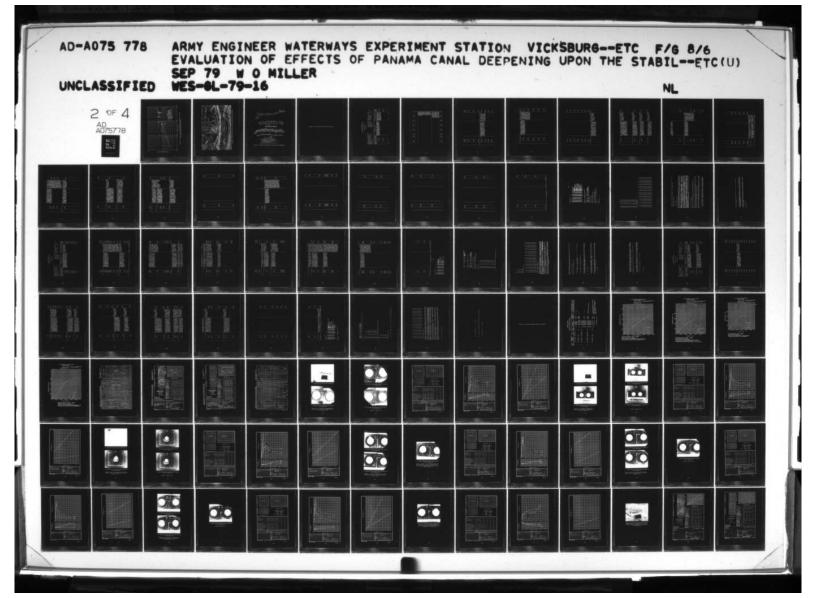
Figure 29. Relationship between distance from blast and weight of charge to maintain factor of safety of 1.0 for conventional analysis using distributed accelerations
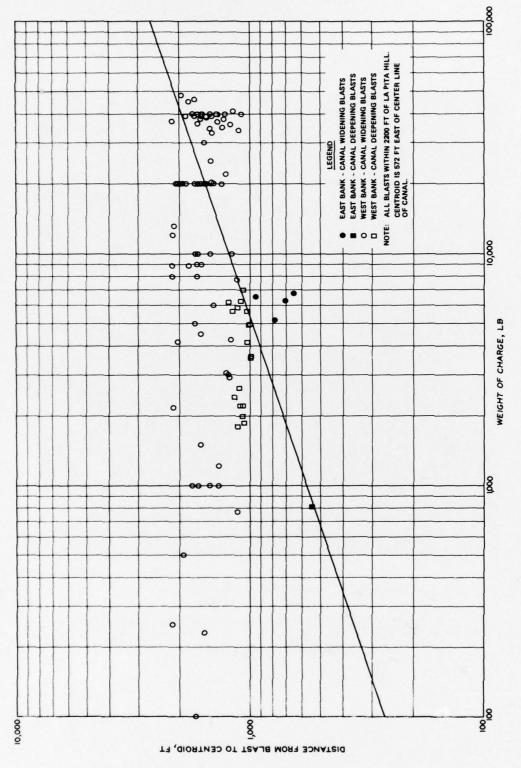
Figure 30. Design curve for regulating blasts adjacent to La Pita Hill
with previous blasting experience shown
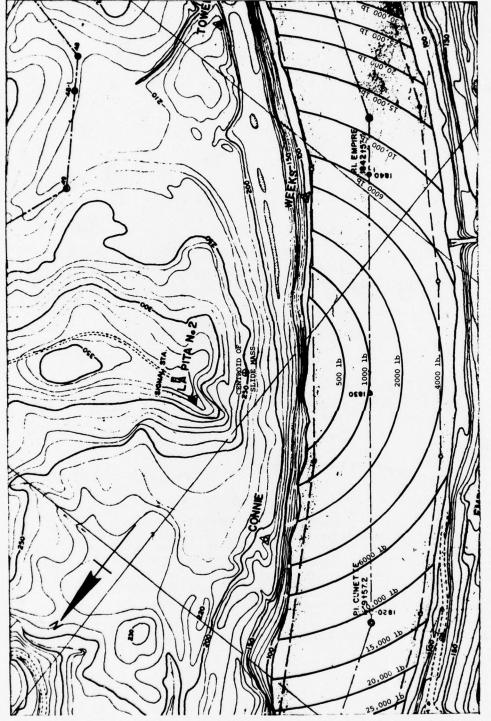
Figure 31. Plan map of La Pita Hill with blast weight regulation contours
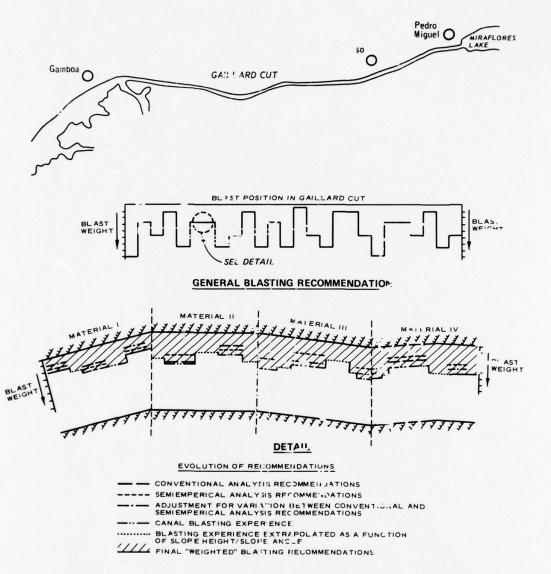
Figure 32. Envisioned development of final blasting recommendations

APPENDIX A: BORING LOGS FOR ERE-25, ERE-26, AND ERE-27

PANAMA CANAL COMPANY

ENGINEERING AND CONSTRUCTION BUREAU

GEOLOGICAL FIELD LOG

1 INCH=2 FT.

PROJECT / LA PITA HILL STUDIES FOR WES   HOLE NO. / ERR - 88   GEOLOGIST / J. L. STEWART

LOCATION / CUNETTE REACH - EAST   LATITUDE N. / 9 4' + 18"   LONGITUDE W. / 79 40' + 1619

COMPLETION DATE / 22 FEB. 1975   STATION / 1830+54   OFFSET / 932' E

CORE RECOVERY / 341.7 FT.   90.2 P/C   GROUND ELEVATION / 339.2   HOLE DEPTH / 380.6 FT.

DRILLER / C. DRAKE   VERTICAL HOLE

ELEVATION IN FEET	DEPTH IN FEET	COLUMNAR SECTION	DESCRIPTION OF MATERIAL	DRILLING CHARACTERISTICS	CORE RECOVERY
339.2	0.0		SILT, CLAY, OM=2, MEDIUM SOFT OVERBURDEN, WEAK, LOW PLASTICITY, LOW DRY STRENGTH, MODERATE WATER CONTENT, RESIDUAL, SAPROLITIC, SILTY CLAY, DERIVED FROM AGGLOMERATE, BY NORMAL WEATHERING PROCESSES, COLOR= MOTTLED RED, BROWN, + LIGHT GREY,	FROM 0.0 FT. TO .8 FT. DRILLED WITH TRICONE ROTARY BIT, NO CORE RECOVERED. ----FROM .9 FT. TO 8.0 FT. PUSH DRILLED DRY WITH .4" CASING, CORE IN DISTURBED CONDITION, H.P=200 TO 600 PSI.	
	1.5				2.1
	4.6			75.4 P/C	
331.2	8.0			4.9 FT.	2.8

11.3	SILT, & CLAY, OR-2, MEDIUM SOFT OVERBURDEN, WEAK, LOW PLASTICITY, LOW DRY STRENGTH, MODERATE WATER CONTENT, RESIDUAL, SAPROLITIC, SILT, & CLAY, DERIVED FROM ANDESITE, BY NORMAL WEATHERING PROCESSES, CONTAINS SCATTERED SILICEOUS NODULES, COLOR- MOTTLED LIGHT & MEDIUM GREY, & MEDIUM YELLOW-BROWN, SEE NOTE 12 IN SUMMARY	FROM 8.0 FT. TO 24.5 FT. PUSH DRILLED DRY WITH 4'' CASING, CORE IN DISTURBED CONDITION. H.P.200 TO 600 PSI.----FROM 24.5 FT. TO 39.7 FT. AS ABOVE. CORE IN DISTURBED CONDITION. H.P.200 TO 380 PSI.----FROM 39.7 FT. TO 44.0 FT. AS ABOVE. CORE IN DISTURBED CONDITION. H.P.200 TO 600 PSI.	2.2
14.6			2.4
17.9			2.0
21.2			2.4
24.5			2.7
26.4			1.9
29.8			1.8

0.2
0.0
1.1
3.0
1.4
1.8
2.7
2.0
2.0

22.8 FT.

63.4 P/C

SILT, & CLAY, OM=2, MEDIUM SOFT OVERBURDEN,
TO OM=3, MEDIUM HARD OVERBURDEN, WEAK TO MODE
RATE STRENGTH, LOW PLASTICITY, LOW DRY STRENG
TH, MODERATE WATER CONTENT, RESIDUAL, SAPROL
ITIC, SILT, & CLAY, DERIVED FROM TUFF, BY
NORMAL WEATHERING PROCESSES, COLOR= RED-BROW
N, AT TOP GRADING TO MOTTLED LIGHT GREY,
+ BUFF, IN LOWER PART NOTE, UPPER CONTACT
IS AN OLD EROSION SURFACE.

FROM 44.0 FT. TO 49
.8 FT. AS ABOVE, CORE I
N DISTURBED CONDITION, MI
P,200 TO 850 PSI.==4
==FROM 49.9 FT. TO
57.4 FT. DRILLED RAPIDLY
+ EASILY WITH 4 X 5-1/2
IN, DOUBLE TUBE, CARBOLOY
BIT + WATER, CORE IN PB
OR, FRAGMENTARY CONDITION,

33.2
34.2
36.2
39.7
43.1
44.0
45.1
47.8
49.8
51.9

295.2

A4

SILT, CLAY, CH-2, MEDIUM SOFT OVERBURDEN; TO CH-3, MEDIUM HARD OVERBURDEN, WEAK TO MODE RATE STRENGTH, LOW PLASTICITY, LOW DRY STRENG TH, MODERATE WATER CONTENT, RESIDUAL, SAPROL ITIC, SILT, CLAY, DERIVED FROM ANDESITE, BY NORMAL WEATHERING PROCESSES, COLOR- MOTT LED DARK RED-BROWN, YELLOW-BROWN, + BUFF, IN UPPER PART GRADING TO MOTTLED MEDIUM BR OWN, + YELLOW-BROWN, IN LOWER PART,

10.6 FT.   79.2 P/C

FROM 57.4 FT. TO 59
.4 FT. DRILLED RAPIDLY +
EASILY WITH 4 X 5-1/2 IN
. DOUBLE TUBE, CARBOLOY B
IT + WATER, CORE IN POOR
, FRAGMENTARY CONDITION;
----FROM 59.4 FT. TO
69.8 FT. DRILLED DRY
WITH 4:1 CASING, CORE I
N DISTURBED CONDITION; M:
P;200 TO 380 PSI;----
--FROM 69.8 FT. TO
76.3 FT. AS ABOVE; CORE
IN DISTURBED CONDITION;
M.P.200 TO 600 PSI;---
--FROM 76.3 FT. TO
92.2 FT. AS ABOVE; CO
RE IN DISTURBED CONDITION;
M.P.200 TO 999 PSI;

2.8

1.1

3.4

2.6

3.5

3.4

57.4

59.4

62.8

66.3

69.8

73.3

281.8

A5

76.3   78.8   81.2   83.7   86.2   88.7   91.1   92.2

247.0

38.7 FT.   92.0 PVC

3.0   2.5   2.4   2.5   2.4   2.4   2.0   1.1

ANDESITE, DH=5, VERY HARD OVERBURDEN, TO RH
=2, MEDIUM SOFT ROCK, WEAK TO MODERATE STRENGT
H, HIGHLY WEATHERED, VERY CLOSE TO CLOSE JOIN
TING, WITH WAVY SLICKENSIDES, JOINTS CONTAIN
SOFTER, BOIL=LIKE MATERIAL, JOINT=BLOCK CENTERS
ARE HARDER & LESS WEATHERED, JOINTS CONTAIN
CALCITE, ZEOLITE, CHLORITE, QUARTZ, AMYGDA
LOIDAL, PORPHYRITIC, ALTERED TO CLAY MINERAL
S, COLOR= MOTTLED DARK GREY, + GREY=GREEN
, & DARK PURPLISH BROWN, SEE NOTE 12 IN SUMMA
RY

FROM 98.2 FT. TO 98
.8 FT. DRILLED RAPIDLY +
EASILY WITH 4 X 5=1/2 IN
. DOUBLE TUBE, CARBOLOY B
IT + WATER, CORE IN GOOD
CONDITION, 0.1 TO 1.3
FT. LENGTHS.

8.7 FT. | 86.0 P/C | 6.0

FROM 98.8 FT. TO 104 +
.9 FT. DRILLED RAPIDLY +
EASILY WITH 4 X 5-1/2 IN
DOUBLE TUBE, CARBOLOY B
IT + WATER. CORE IN GOOD
CONDITION 0.1 TO 1.7
FT. LENGTHS.

TUFF, AGGLOMERATIC, QM-3, MEDIUM HARD OVERBU
RDEN. TO QM4, HARD OVERBURDEN, MODERATE STR
ENGTH. WEATHERED, VERY CLOSE TO CLOSE JOINTING
, JOINTS CONTAIN SOFTER, SOIL-LIKE MATERIAL, J
OINT-BLOCK CENTERS ARE HARDER + LESS WEATHERED,
INDETERMINATE BEDDING, FINE-TO MEDIUM-GRAINED
, TUFFACEOUS, VOLCANIC DEBRIS, ANDESITIC,
DACITIC, AGGLOMERATIC, CONTAINS ABUNDANT AG
GLOMERATIC MATERIAL, ALTERED TO CLAY MINERALS,
COLOR- MOTTLED LIGHT GREY, LIGHT REDBR
OWN, + LIGHT GREY-GREEN, IN UPPER PART GR
ADING TO MOTTLED LIGHT GREY-GREEN, IN LOWER
PART. NOTE/ UPPER CONTACT IS AN OLD EROSION SU
RFACE.

98.8
99.1
240.4

9.1 FT. | 89.9 P/C | 8.2

FROM 106.7 FT. TO 113
.8 FT. AB ABOVE. CORE I
N GOOD CONDITION 0.1 TG
0.7 FT. LENGTHS.

TUFF, QM-3, MEDIUM HARD OVERBURDEN, TO RM-2
, MEDIUM SOFT ROCK, MODERATE STRENGTH, WEATHE
RED, CLOSE JOINTING, JOINTS IRON-STAINED + OX
IDIZED, JOINTS CONTAIN THIN CALCITE FILMS, MA
SSIVE BEDDING, FINE-TO MEDIUM-GRAINED, WATER-
LAID, TUFFACEOUS, VOLCANIC DEBRIS, ALTERED
TO CLAY MINERALS, COLOR- MOTTLED DARK + MEDI
UM BLUE-GREY, NOTE/ CORE HYDRATES, SWELLS + DI
SINTEGRATES ON EXPOSURE TO AIR.

106.7
108.1
232.5

4.8 FT. | 100.0 P/C | 4.7

FROM 111.5 FT. TO 116
.8 FT. AB ABOVE. CORE I
N GOOD CONDITION 0.1 TG
0.9 FT. LENGTHS.

ANDESITE, AMYGDALOIDAL, QM-5, VERY HARD OVER
BURDEN, TO RM-3, MEDIUM HARD ROCK, MODERATE
STRENGTH, WEATHERED, CLOSE JOINTING, WITH H
AVY SLICKENSIDES, JOINTS IRON-STAINED + O
XIDIZED, SOME JOINTS CONTAIN CALCITE, MEDIUM
-TO COARSE-GRAINED, AMYGDALOIDAL, ALTERED TO
CLAY MINERALS, COLOR- MOTTLED DARK + MEDIUM
GREY.

111.5
112.8
227.7

5.0 FT. | 92.6 P/C | 3.7

FROM 116.9 FT. TO 122
.8 FT. AB ABOVE. CORE I
N DISTURBED CONDITION.

AGGLOMERATE, QM-5, VERY HARD OVERBURDEN, TO
RM-3, MEDIUM HARD ROCK, MODERATE STRENGTH, WE
ATHERED, CLOSE TO MODERATE JOINTING, WITH WAV
Y SLICKENSIDES, JOINTS IRON-STAINED + OXIDIZED
, MASSIVE BEDDING, ANGULAR TO SUBANGULAR, AN
DESITIC, BASALTIC, FRAGMENTS, UP TO 1.5 FT.
IN DIAMETER, IN A FINE-GRAINED, TUFFACEOUS MATR

116.9
222.3

IX, OF SIMILAR COMPOSITION, HIGHLY ALTERED T
O CLAY MINERALS, COLOR= MOTTLED LIGHT GREY
GREY=GREEN, BUFF, + MEDIUM RED=BROWN,
NOTE(CORE HYDRATES/ SWELLS + DISINTEGRATES ON E
XPOSURE TO AIR(

18.1 /T,   100.0 P/C

FROM 129.0 FT. TO 158
.8 FT(DRILLED SLOWLY + D
IFFICULT(WITH 4" X 5=1/
2 IN. DOUBLE TUBE, CARBOL
OY BIT + WATER, CORE QRQ
UND + BLOCKED, CORE IN GO
OD CONDITION 0.1 TO 8
.8 FT(LENGTHS,==---=FROM
150.0 FT, TO 158.4
FT, AS ABOVE, CARBOLOY B
IT, + DRILLING MUD, CORE I
N GOOD CONDITION 0.1 TO
0.8 FT(LENGTHS(=--=---
FROM 158.4 FT, TO 188
.0 FT, AS ABOVE, DIAMOR
D BIT + DRILLING MUD, CO
RE IN GOOD CONDITION 0.1
TO 0.8 FT, LENGTH(=SE
E NOTE 13 IN SUMMARY

ANDESITE, AMYGDALOIDAL, QM=5, VERY HARD OVER
BURDEN, TO RM=8, MEDIUM HARD ROCK, MODERATE
STRENGTH, WEATHERED, VERY CLOSE JOINTING, JO
INTS IRON=STAINED + OXIDIZED, SOME JOINTS CONT
AIN CALCITE, MEDIUM=TO COARSE=GRAINED, AMYG
DALOIDAL, HIGHLY ALTERED TO CLAY MINERALS,
COLOR= MOTTLED DARK + MEDIUM GREY,

9.0

7.0

2.5

3.8

125.9

129.0

133.3

135.8

141.0

210.2

A8

6.4

1.4

2.5

2.9

2.6

27.0 FT.   90.0 P/C
FROM 159.0 FT. TO 159
.8 FT: DRILLED RAPIDLY
SEE NOTE 101
8.14 FT.   100.0 P/C

FROM 160.4 FT. TO 162
.8 FT: AS ABOVE, CORE I
N GOOD CONDITION 0.1 TO
1.5 FT. LENGTHS.
6.8 FT.   100.0 P/C

AGGLOMERATE, CM-8, VERY HARD OVERBURDEN, STRO
NG, WEATHERED, CLOSE JOINTING, SLICKENSIDED
SEE NOTE 100

AGGLOMERATE, TUFFACEOUS, RM=3, MEDIUM HARD RO
CK, TO RM=4, HARD ROCK, MODERATELY STRONG TO
STRONG, MODERATE JOINTING, WITH MANY SLICKENS
IDES, INDETERMINATE BEDDING, SUBANGULAR TO SU
SEE NOTE 102

147.8

150.0

152.7

155.8

158.4
159.0

160.4

162.2

180.2

178.8

177.0

A9

TUFF, RM=3, MEDIUM HARD ROCK, TO RM=1, VERY
SOFT ROCK, WEAK TO MODERATE STRENGTH, VERY CLO
SE TO CLOSE JOINTING, WITH WAVY SLICKENSIDES,
THIN BEDDING, BEDS DIP 16 DEGREES, FINE-T
O MEDIUM-GRAINED, WATER-LAID, TUFFACEOUS,
VOLCANIC DEBRIS, HIGHLY ALTERED TO CLAY MINER
AL, COLOR, DARK RED-BROWN, IN UPPER PART
GRADING TO MOTTLED MEDIUM + DARK GREY, AT B
ASE. NOTE, CORE HYDRATES, SWELLS + DISINTEGRATE
S ON EXPOSURE TO AIR. NOTE/LOWER CONTACT IS S
HARP, SEE NOTE 12 IN SUMMARY

FROM 162.2 FT. TO 165
.8 FT. AS ABOVE. CORE I
N GOOD CONDITION. 0.1 TO
0.4 FT. LENGTHS.
FROM 165.8 FT. TO 167
.8 FT DRILLED SLOWLY WIT
H, X 5-1/2 IN. DOUBLE T
UBE, DIAMOND BIT + DRILLE
N MUD, TOO SOFT TO RETA
IN IN CORE BARREL, CORE I
N POOR, FRAGMENTARY CONDIT
ION. DROPPED CORE, GROUND
SAMPLE DURING RECOVERY.
FROM 167.8 FT. TO
168.8 FT. DRILLED DRY WI
TH 4, CASING, CORE IN
DISTURBED CONDITION. WIPA
999 PSI.FROM 168
.8 FT. TO 170.0 FT. DR
ILLED DRY WITH DIAMOND BI
T + DRILLING MUD, CORE &
N DISTURBED CONDITION.
FROM 170.0 FT. TO 0.7
FT. LENGTHS.SEE NOTE 13
IN SUMMARY

ANDESITE, AMYGDALOIDAL, RM=4, HARD ROCK, ST
RONG, CLOSE TO MODERATE JOINTING, JOINTS CON
TAIN, CALCITE, ZEOLITE, CHLORITE, FINE-TO ME
DIUM-GRAINED, EXTRUSIVE, AMYGDALOIDAL, AMYG
DULES CONTAIN CALCITE, ZEOLITE, CHLORITE CO
LOR, MEDIUM + DARK PURPLISH GREY, IN UPPER P
ART GRADING TO MEDIUM TAN, AT BASE.

FROM 173.7 FT. TO 175
.0 FT. DRILLED RAPIDLY +
EASILY WITH, X 5-1/2 IN
, DOUBLE TUBE, CARBOLOY
IT + DRILLING MUD, CORE I
N GOOD CONDITION. 0.1 TO
1.7 FT. LENGTHS.

6.3
1.2
2.2
4.7

165.8
167.8
170.0
173.7
175.4
165.5

82.5 PFC
8.6 FT.

A10

TUFF, AGGLOMERATIC, RM-3, MEDIUM HARD ROCK, TO RM4, HARD ROCK, MODERATELY STRONG TO STRONG, MODERATE JOINTING, SOME JOINTS CONTAIN THIN CALCITE FILMS, THIN BEDDING, BEDS DIP 21 DEGREES, MEDIUM TO COARSE-GRAINED, MATERIAL ID, TUFFACEOUS, VOLCANIC DEBRIS, AGGLOMERATIC, CONTAINS SCATTERED FINE AGGLOMERATIC MATERIAL, ALTERED TO CLAY MINERALS, FINER GRAINED IN UPPER PART BECOMING COARSER WITH DEPTH, COLOR: DARK RED-BROWN, AT TOP GRADING TO MOTTLED DARK + MEDIUM GREY, IN LOWER PART, SOME R CONTACT IS GRADATIONAL. NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO AIR. NOTE/ UPPER CONTACT IS AN OLD EROSION SURFACE.

16.1 FT.   93.1 P/C

FROM 191.0 FT. TO 198.8 FT. AS ABOVE. CORE IN GOOD CONDITION. 0.1 TO 1.3 FT. LENGTHS.

AGGLOMERATE, RM-3, MEDIUM HARD ROCK, TO RM-4, HARD ROCK, STRONG, CLOSE TO MODERATE JOINTING, INDETERMINATE BEDDING, SUBANGULAR TO SUBROUNDED, ANDESITIC, BASALTIC FRAGMENTS, UP TO 8+ FT. IN DIAMETER, IN A COARSE-GRAINED, TUFFACEOUS MATRIX, OF SIMILAR COMPOSITION, ALTERED TO CLAY MINERALS, FINER GRAINED IN UPPER PART BECOMING COARSER WITH DEPTH, COLOR: MOTTLED GREY, + GREY-GREEN, NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO AIR,

7.2 FT.   100.0 P/C

FROM 198.2 FT. TO 208.8 FT. AS ABOVE. CORE IN GOOD CONDITION. 0.1 TO 1.2 FT. LENGTHS. FROM 202.8 FT. TO 209.8 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN. DOUBLE TUBE, DIAMOND BIT + DRILLING MUD, CORE IN GOOD CONDITION. 0.1 TO 1.4 FT. LENGTHS.

185.4   191.0   193.1   198.2   202.8

148.2   141.0

2.5   7.7   9.7

A11

TUFF, AGGLOMERATIC, RM-3, MEDIUM HARD ROCK, MODERATE STRENGTH, CLOSE JOINTING, WITH WAVY SLICKENSIDES, SOME JOINTS CONTAIN THIN CALCITE FILMS, THIN BEDDING, BEDS DIP 21 DEGREES, MEDIUM-TO COARSE-GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC DEBRIS, AGGLOMERATIC, CONTAINS SCATTERED FINE AGGLOMERATIC MATERIAL, SEE NOTE 103

10.8 FT.   100.0 P/C
FROM 209.0 FT. TO 212.0 FT, DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN DOUBLE TUBE, DIAMOND BIT + DRILLING MUD, CORE IN GOOD CONDITION, 0.1 TO 0.4 FT. LENGTHS, SEE NOTE 104

TUFF, RM-1, SOFT ROCK, TO RM-2, MEDIUM SOFT ROCK, WEAK, VERY CLOSE JOINTING, WITH PHANA + WAVY SLICKENSIDES, THIN BEDDING, FINE TO MEDIUM-GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC DEBRIS, AGGLOMERATIC, IN LOWER PART, FINER GRAINED IN UPPER PART, ALTERED TO CLAY MINERALS, BECOMING COARSER WITH DEPTH, COLOR= DARK RED-BROWN, NOTE/ CORE HYDRATES, SWELLS & DISINTEGRATES ON EXPOSURE TO AIR, NOTE/ UPPER CONTACT IS AN OLD EROSION SURFACE.

8.0 FT.   100.0 P/C
FROM 212.0 FT. TO 220.7 FT. AS ABOVE, CORE IN GOOD CONDITION, SEE NOTE 13 IN SUMMARY

ASH FLOW, RM-9, HARD ROCK, TO RM-5, VERY HARD ROCK, STRONG, CLOSE TO MODERATE JOINTING, JOINTS CONTAIN CALCITE, CHLORITE, ZEOLITE, MASSIVE BEDDING, ANGULAR TO SUBANGULAR, PUMICEOUS, ANDESITE, BASALT, FRAGMENTS, UP TO 0.2 FT. DIAMETER, IN A TUFFACEOUS MATRIX, OF SIMILAR COMPOSITION, AN IGNIMBRITE, APPARENTLY DEPOSITED IN A SEMI-MOLTEN CONDITION, WELDED TOGETHER BY OWN HEAT, COLOR= MOTTLED GREY, LIGHT GREY, PURPLISH GREY, + GREY-GREEN, SEE NOTE 12 IN SUMMARY

6.2 FT.   71.3 P/C
FROM 220.7 FT. TO 228.8 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN DOUBLE TUBE, DIAMOND BIT + DRILLING MUD, CORE IN EXCELLENT CONDITION 0.1 TO 0.2 FT. LENGTHS

4.8

0.0

0.4

4.2

207.6
209.0
212.0
214.6
216.5
220.7

130.2

127.2

118.5

9.0

10.0

9.6

230.4

240.4

250.0

A13

ANDESITE; BRECCIATED, RM=4, HARD ROCK, TO R
M=5, VERT HARD ROCK; STRONG; DENSE; VERY CLO
SE JOINTING; WITH PLANAR + WAVY SLICKENSIDE;
SOME JOINTS OPEN; JOINTS CONTAIN CALCITE,
ZEOLITE, CALCITE; QUARTZ, JOINTS DIP AT RAND
OM ANGLES, FINE-GRAINED, BRECCIATED; INTRUS
IVE; COLOR, MEDIUM + DARK GREY, + BLACK,
SEE NOTE 12 IN SUMMARY

FROM 258.3 FT. TO 266
8 FT. DRILLED SLOWLY WIT
H , R 5-1/2 IN. DOUBLE T
UBE, CARBOLOY BIT + DRILL
ING MUD, CORE IN GOOD COR
DTION 0.1 TO 1.2 FT
. LENGTHS:----FROM 266
.8 FT. TO 299.8 FT. DB
ICLED RAPIDLY + EASILY WIT
M , X 5-1/2 IN. DOUBLE T
UBE, DIAMOND BIT + DRLLE
NG MUD, CORE IN GOOD COR
DTION, 0.1 TO 3.0 FT
. LENGTHS----FROM 299
.8 FT. TO 344.6 FT. DB
ICLED SLOWLY + DIFFICULTLY
WITH , X 5-1/2 IN. DOUB
LE TUBE, DIAMOND BIT + DB
ILLING MUD, CORE IN GOOD
CONDITION 0.1 TO 0.8
FT. LENGTHS----FROM
344.6 FT. TO 380.6 FT
. DRILLED RAPIDLY + EASILY
WITH , X 5-1/2 IN. DOUB
LE TUBE, DIAMOND BIT + DB
ILLING MUD, CORE IN GOOD
CONDITION 0.1 TO 1.6
FT. LENGTHS.SEE NOTE 13
IN SUMMARY

38.7 FT.   95.0 PZC

2.4
1.8
1.9
7.2
7.0

283.4
256.4
258.3
266.5
272.5
80.9

A17

BOTTOM OF HOLE

117.2 FT.

95.9 FCC

7.0

8.5

5.5

5.6

361.4

367.0

373.6

380.6

A19

1. TYPE OF MATERIAL

ELEVATION		DEPTH		
339.2 TO	331.2	0.0 TO	8.0	SILT, CLAY,
331.2 TO	295.2	8.0 TO	44.0	SILT, CLAY,
295.2 TO	281.8	44.0 TO	57.4	SILT, CLAY,
281.8 TO	247.0	57.4 TO	92.2	SILT, CLAY,
247.0 TO	240.4	92.2 TO	98.8	ANDESITE,
240.4 TO	232.5	98.8 TO	106.7	TUFF, AGGLOMERATIC,
232.5 TO	227.7	106.7 TO	111.5	TUFF,
227.7 TO	222.3	111.5 TO	116.5	ANDESITE, AMYGDALOIDAL,
222.3 TO	210.2	116.5 TO	129.0	AGGLOMERATE,
210.2 TO	180.2	129.0 TO	159.0	ANDESITE, AMYGDALOIDAL,
180.2 TO	178.8	159.0 TO	160.4	AGGLOMERATE,
178.8 TO	177.0	160.4 TO	162.2	AGGLOMERATE, TUFFACEOUS,
177.0 TO	165.5	162.2 TO	173.7	TUFF,
165.5 TO	148.2	173.7 TO	191.0	ANDESITE, AMYGDALOIDAL,
148.2 TO	141.0	191.0 TO	198.2	TUFF, AGGLOMERATIC,
141.0 TO	130.2	198.2 TO	209.0	AGGLOMERATE,
130.2 TO	127.2	209.0 TO	212.0	TUFF, AGGLOMERATIC,
127.2 TO	118.5	212.0 TO	220.7	ANDESITE,
118.5 TO	80.9	220.7 TO	258.3	ASH FLOW,
80.9 TO	-41.4	258.3 TO	380.6	ANDESITE, BRECCIATED,
-41.4		380.6		BOTTOM OF HOLE

2. ENGINEERING + GEOLOGICAL FORMATION CONTACTS

ELEVATION		DEPTH		
339.2 TO	247.0	0.0 TO	98.2	OVERBURDEN
247.0 TO	178.8	92.2 TO	160.4	WEATHERED ROCK
178.8 TO	-41.4	160.4 TO	380.6	SOUND ROCK
339.2 TO	-41.4	0.0 TO	380.6	LAS CASCADAS FM.

3. AMOUNT OF CASING USED

84.0 FT. OF 8'' CASING
Edge of 6'' casing

4. AMOUNT OF PIPE OR CASING LEFT IN HOLE

84.0 FT. OF 6'' CASING LEFT IN HOLE

380.0 FT. OF PVC,2'' PLASTIC PIPE INSTALLED

5. PURPOSE OF HOLE / GEOLOGIC EXPLORATION + SAMPLING.

6. WATER TABLE

ELEVATION   DEPTH   DATE

```
269.0   70.2   21/ 1/75
259.0   80.2   22/ 1/75
247.7   71.5   83/ 1/75
286.2   53.0   84/ 1/75
253.8   85.4   85/ 1/75
259.1   80.1   87/ 1/75
278.9   60.3   88/ 1/75
275.1   64.1   89/ 1/75
277.0   62.2   31/ 1/75
262.6   76.6    3/ 2/75
296.5   42.7    8/ 2/75
281.6   57.6   12/ 2/75
257.0   82.2   13/ 2/75
283.6   85.6   14/ 2/75
281.0   58.2   15/ 2/75
262.9   76.3   17/ 2/75
271.6   67.6   18/ 2/75
```

10: CORE BOX NUMBERS AND DEPTHS

```
 1)   0.0    7.8    2)   7.8   13.6    3)  13.6   20.7    4)  20.7   26.0    5)  26.0   37.7
 6)  37.7   44.7    7)  44.7   48.2    8)  48.2   55.1    9)  55.1   60.2   10)  60.2   65.0
11)  65.0   69.3   12)  69.3   75.0   13)  75.0   78.4   14)  78.4   81.2   19)  81.2   86.2
16)  86.2   89.6   17)  89.6   93.6   18)  93.6   98.8   19)  98.8  104.2   20) 104.2  109.3
21) 109.0  113.6   22) 113.6  118.4   23) 118.4  123.2   24) 123.2  127.7   25) 127.7  132.5
26) 132.5  135.8   27) 135.8  145.7   28) 145.7  150.0   29) 145.7  150.0   30) 150.0  155.3
31) 155.3  159.4   32) 159.4  165.8   33) 165.8  171.3   34) 171.3  176.5   35) 176.5  181.3
36) 181.3  186.3   37) 186.3  191.6   38) 191.6  196.3   39) 196.3  200.9   40) 200.9  205.8
41) 205.8  209.9   42) 209.9  216.5   43) 216.5  220.7   44) 220.7  225.7   45) 225.7  230.4
46) 230.4  234.8   47) 234.8  239.8   48) 239.8  244.9   49) 244.9  250.0   50) 250.0  252.2
51) 252.2  258.3   52) 258.3  264.0   53) 264.0  268.5   54) 268.5  272.8   55) 272.8  277.2
56) 277.2  282.0   57) 282.0  286.7   58) 286.7  291.1   59) 291.1  295.3   60) 295.3  299.9
61) 299.9  306.4   62) 306.4  310.0   63) 310.0  313.6   64) 313.6  317.3   65) 317.3  322.3
66) 322.3  326.6   67) 326.6  331.1   68) 331.1  335.5   69) 335.5  340.0   70) 340.0  344.6
```

71) 344.6   721 347.8   352.9   731 352.9   357.6   7) 357.6   361.6   75) 361.6   366.0

76) 366.0   371.2   771 371.2   375.8   781 375.8   379.0   79) 379.0   380.6

11. DRILL WATER CIRCULATION LOSSES

    FROM   TO

    50.0   85.0

12. ADDITIONAL DESCRIPTIVE INFORMATION

SILT + CLAY, DEPTH 8.0'-44.0', IS DERIVED FROM AN AMYGDALOIDAL ANDESITE.   SILT + CLAY, 44.0'-57.4', THE MA
TERIAL FROM 50.0'-57.4' RESEMBLES WEATHERED ROCK, VERY HIGHLY ALTERED TO MONTMORILLONITIC + BENTONITIC CLAY MIN
ERALS(CH-3; MEDIUM HARD OVERBURDEN)   SILT + CLAY, 57.4'-92.2', IS CH-4; HARD OVERBURDEN; IN THE LOWER 1.0
'.

ANDESITE, 92.2'-98.8', HAS STEEPLY DIPPING JOINTS IN UPPER PORTION, DIP 77 DEGREES, THIS MATERIAL IS ALL IN A
SHEAR ZONE.   TUFF, AGGLOMERATIC, 98.8'-106.7', HAS A SHEAR ZONE, 102.0'-10.2'.   TUFF, 106.7'-111.8',
HAS A SLICKENSIDED SHEAR ZONE AT 106.7' WITH GOUGE, SLICKENSIDES DIP 25-30 DEGREES,   AGGLOMERATE, 116.9'-12
9.0', HAS A HIGHLY ALTERED SHEAR ZONE, 121.5'-129.0'.   ANDESITE, 129.0'-159.0', IS ALL A SHEAR ZONE.

TUFF, 162.2'-173.7', HAS A FAULT WITH SOFT PLASTIC GOUGE, 162.2'-170.2), A PLANAR SLICKENSIDE AT 170.2' DIPPIN
G 42 DEGREES, MATERIAL IS SHEARED 170.2'-173.7), + JOINTS HAVE SOFT PLASTIC GOUGE AT 171.8', + FROM 172.4'-172
.5'.   TUFF, AGGLOMERATIC, 209.0'-212.0', TUFF, 212.0'-220.7', HAVE A FAULT ZONE, 210.7'-220.7', WITH SOFT
PLASTIC GOUGE, 211.3'-211.5', NUMEROUS PLANAR SLICKENSIDES + THE FAULT CONTACT AT 212.0'.

ASH FLOW, 220.7'-258.3', IS SHEARED + BROKEN, 220.7'-224.7', HAS A STEEPLY DIPPING FAULT, 73 DEGREES, AT 258.4
, SHOWING VERTICAL MOTION, IS SHEARED, BROKEN + SLICKENSIDED, 2511-258.3.) + IS PERLITIC BELOW 253.4'. (PERL
ITIC MATERIAL POSSIBLY FAULTED IN PLACE.)   ANDESITE, BRECCIATED, 258.3'-380.0', IS VERY HIGHLY SLICKENSIDE
D + BROKEN BELOW 286.0'. BETWEEN 299.5' + 344.6' MATERIAL IS EXTREMELY CLOSELY JOINTED, AT 375.0' THERE IS A N
EAR VERTICAL, HEALED FAULT.
ANDESITE, 258.2'-380.6', CONT'D., THIS IS AN OLD FAULT WITH HORIZONTAL MOTION. THE SAMPLES TAKEN FROM THIS HOLE
SHOW NUMEROUS VERTICAL + NEAR VERTICAL JOINTS + BREAKS.

13. ADDITIONAL DRILLING INFORMATION

HOLE WAS CAVING BADLY, DRILLER GROUTED HOLE TO 180.0', CLEANED HOLE + STARTED DRILLING WITH MUD.

DROPPED ONE JAW FROM SLIPS IN HOLE, RECOVERED SLIP JAW WITH 5-1/2 INCH OUTER BARREL IN RUN, 168.8'-170.0'.

80 P/C WATER RETURN, 92.2'-112.8', 80 P/C RETURN 112.8'-116.9', 80 P/C RETURN 116.9'-136.8', LOST ALL DRILLIN
G MUD RETURN AT 230.4', ADDED 3 SACKS OF AQUAGEL + LIME, + GOT 100 P/C RETURN.

8 IN. FLUSH JOINT CASING CAME APART IN TWO PLACES + HAD TO BE FISHED OUT.

CORE BETWEEN 299.5' + 344.6' WAS RECOVERED IN GOOD CONDITION, BUT THE ANDESITE WAS SO CLOSELY JOINTED + SHEARE
D THAT IT FELL APART UPON REMOVAL FROM CORE BARREL, THE SMALLEST PIECES RECOVERED WERE LESS 0.01' IN DIAMETER.

100. , JOINTS IRON-STAINED + OXIDIZED,   INDETERMINATE BEDDING,   ANGULAR TO SUBANGULAR,   ANDESITIC, FR
AGMENTS, IN A FINE-GRAINED, TUFFACEOUS MATRIX,   ALTERED TO   CLAY MINERALS, COLOR-   MOTTLED LIGHT
+ MEDIUM GREY-GREEN.   +   RED-BROWN,   NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO
AIR.

A22

101. EASILY WITH 4 X 5-1/2 IN. DOUBLE TUBE, DIAMOND BIT + DRILLING MUD,   CORE IN FAIR CONDITION 0-1
     TO 0-4 FT. LENGTHS.

102. B-ROUNDED, ANDESITIC, BASALTIC, FRAGMENTS, UP TO 0.2 FT. DIAMETER, IN A FINE-GRAINED, TUFFACE
     OUS MATRIX, OF SIMILAR COMPOSITION, ALTERED TO CLAY MINERALS, COLOR- MOTTLED GREY, GREY-G
     REEN, + DARK PURPLISH GREY, NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO AIR, NO
     TE/ LOWER CONTACT IS SHARP.

103. ALTERED TO CLAY MINERALS, FINER GRAINED IN UPPER PART BECOMING COARSER WITH DEPTH, COLOR- MOTTLE
     D DARK + MEDIUM GREY, NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO AIR, NOTE/ LO
     WER CONTACT IS SHARP.

104. TE 13 IN SUMMARY

A23

PANAMA CANAL COMPANY

ENGINEERING AND CONSTRUCTION BUREAU

GEOLOGICAL FIELD LOG

1 INCH= FT.

PROJECT / LA PITA HILL STUDIES FOR WES   HOLE NO. /ERE - 26   GEOLOGIST / J. L. STEWART

LOCATION / CUNETTE REACH - EAST   LATITUDE N. / 9 41' + 1026   LONGITUDE N. / 79 40' + 1597

COMPLETION DATE / 22 MAR. 1975   STATION / 1832+47   OFFSET / 812' E

CORE RECOVERY / 271.3 FT.   90.4 P/C   GROUND ELEVATION / 307.8   HOLE DEPTH / 300.2 FT.

DRILLER / C. DRAKE   VERTICAL HOLE

ELEVATION IN FEET	DEPTH IN FEET	COLUMNAR SECTION	DESCRIPTION OF MATERIAL	DRILLING CHARACTERISTICS	CORE RECOVERY
307.8	0.0		SILT, CLAY, OH=2, MEDIUM SOFT OVERBURDEN, TO OH=3, MEDIUM HARD OVERBURDEN, WEAK, LOW PLASTICITY, LOW DRY STRENGTH, LOW WATER CONTENT, RESIDUAL, SAPROLITIC, SILT, CLAY, DERIVED FROM ANDESITE, BY NORMAL WEATHERING PROCESSES, HARDNESS INCREASES WITH DEPTH, CLAYEY AT TOP BECOMING SILTIER WITH DEPTH. COLOR MOTTLED LIGHT + MEDIUM GREY, + MEDIUM YELLOW-BROWN.	FROM 0.0 FT. TO 26.3 FT. DRILLED DRY WITH 4" CASING. CORE IN DISTURBED CONDITION. M.P.200 TO 550 PSI.	
	3.4				1.7
	5.8				1.8
	8.1				1.9
	11.4				2.4
	13.7				2.2
	16.0				1.0
	19.2				3.0

FROM 26.3 FT. TO 26
.8 FT. AS ABOVE, CORE I
N DISTURBED CONDITION. ==
==FROM 26.8 FT. TO
28.8 FT. DRILLED RAPIDL
Y + EASILY WITH 4" CASI
NG, + WATER, CORE IN FA
IR CONDITION 0.1 TO 0
.4 FT. LENGTHS==FROM
28.8 FT. TO 30.7
FT. DRILLED RAPIDLY + EASI
LY WITH 4 X 5-1/2 IN. DO
UBLE TUBE, DIAMOND BIT +
WATER, CORE GROUND + BLOC
KED, CORE IN FAIR CONDITI
ON 0.1 TO 0.4 FT. LE
NGTHS==FROM 30.7
FT. TO 34.3 FT. DRILLE
D RAPIDLY + EASILY WITH
4 X 5-1/2 IN. DOUBLE TUBE,
CARBOLOY BIT + WATER, CO
RE IN FAIR CONDITION 0.1
TO 0.4 FT. LENGTHS==
==FROM 34.3 FT. TO
44.7 FT. DRILLED RAPIDL
Y + EASILY WITH 4 X 5-1/
2 IN. DOUBLE TUBE, CARBOL
OY BIT + DRILLING MUD, CO
RE GROUND + BLOCKED, CORE
SEE NOTE 100

FROM 46.8 FT. TO 60
.3 FT. DRILLED DRY WITH
4" CASING, CORE IN DIST
URBED CONDITION.

20.5 FT.   78.0 P/C

14.6 FT.   71.3 P/C

8.3 FT.   61.5 P/C

ANDESITE, QM-3, MEDIUM HARD OVERBURDEN, TO
RH=, HARD ROCK, MODERATE STRENGTH, WEATHERED,
VERY CLOSE TO CLOSE JOINTING, JOINTS IRON-ST
AINED + OXIDIZED, JOINTS CONTAIN ABUNDANT SOFT
ER, SOIL-LIKE MATERIAL, JOINT-BLOCK CENTERS ARE
HARDER + LESS WEATHERED, COLOR= MOTTLED MEDIUM
BROWN, YELLOW-BROWN, RED-BROWN, IN UPPER PAR
T GRADING TO MOTTLED MEDIUM + DARK GREY,
MEDIUM BROWN, + MEDIUM PURPLISH GREY, IN LOW
ER PART   SEE NOTE 12 IN SUMMARY

CLAY, SANDY, QM-1, SOFT OVERBURDEN, TO QM-3
, MEDIUM HARD OVERBURDEN, WEAK TO MODERATE STR
ENGTH, MODERATE TO HIGH PLASTICITY, LOW TO MOD
ERATE DRY STRENGTH, MODERATE TO HIGH WATER CON
TENT, RESIDUAL, SAPROLITIC, SILT, CLAY,
DERIVED FROM TUFF, BY NORMAL WEATHERING PROCE
SSES, COLOR= MOTTLED MEDIUM BROWN, + YELL
OW-BROWN, AT TOP RED-BROWN, IN CENTRAL PART,
+ MOTTLED MEDIUM GREY, + BUFF, IN UPP
ER PART

2.8
2.0
2.2
1.7
1.5
1.5
1.3
1.7
1.2
2.3
1.7
3.3
2.9
2.5
2.3

22.0
2.6
26.3
26.8
28.8
3.7
32.2
3.3
36.3
40.3
4.7
46.8
48.3
5.1
57.4
60.3

281.5

261.0

247.5

A25

AGGLOMERATE, OM=4, HARD OVERBURDEN, VERY TO RM=4, HARD ROCK, STRONG, WEATHERED, VERY CLOSE TO CLOSE JOINTING, WITH WAVY SLICKENSIDES, JOIN TS IRON=STAINED + OXIDIZED, JOINTS CONTAIN CA LCITE, CHLORITE, ZEOLITE, SUBANGULAR TO SUB= ROUNDED, ANDESITE, FRAGMENTS, UP TO 4=5 FT. IN DIAMETER, IN A TUFFACEOUS MATRIX, OF SIMIL AR COMPOSITION, ALTERED TO CLAY MINERALS, WE ATHERING DECREASES + HARDNESS INCREASES WITH DEP TH. COLOR= DARK RED=BROWN, DARK + MEDIUM GREY, IN UPPER PART GRADING TO MOTTLED MEDI UM GREY, + DARK PURPLISH GREY, IN CENTRAL P ART,

FROM 60.3 FT. TO 62 .4 FT. DRILLED DRY WITH 4.1 CASING, CORE IN DIST URBED CONDITION. =====FR OM 62.4 FT. TO 84.4 FT. DRILLED SLOWLY + DIF FICULTY WITH 4 X 5=1/2 IN. DOUBLE TUBE, CARBOLOY BIT + DRILLING MUD, CORE IN GOOD CONDITION 0.1 TO 2.0 FT. LENGTHS.===== FROM 84.4 FT. TO 92.3 FT. DRILLED SLOWLY + DIFFICULTLY WITH 4 X 5= 1/2 IN. DOUBLE TUBE, CARB OLOY BIT + WATER, CORE I N GOOD CONDITION, 0.1 TO 1.6 FT. LENGTHS.SEE NO TE 13 IN SUMMARY

1.3
0.8

9.8

TUFF, OM=5, VERY HARD OVERBURDEN, TO RM=3, MEDIUM HARD ROCK, MODERATE STRENGTH, WEATHERE D, VERY CLOSE TO CLOSE JOINTING, WITH WAVY SL ICKENSIDES, JOINTS IRON=STAINED + OXIDIZED, SOME JOINTS CONTAIN CHLORITE, INDETERMINATE BEDDING, FINE=TO MEDIUM=GRAINED, WATER=LAID, TUFFACEOUS, VOLCANIC DEBRIS, CONTAINS SCATT ERED AGGLOMERATIC MATERIAL, HIGHLY ALTERED TO CLAY MINERALS, COLOR= DARK RED=BROWN, NOTE SEE NOTE 101

31.1 FT.   97.2 P/C
FROM 92.3 FT. TO 99 .0 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5=1/2 IN . DOUBLE TUBE, CARBOLOY B IT + WATER, CORE IN GOOD CONDITION, 0.1 TO 0.4 FT. LENGTHS++ A DRY=BLOC K PLUG.

9.8
2.4
2.4
2.4

TUFF, AGGLOMERATIC, OM=5, VERY HARD OVERBURD EN, STRONG, WEATHRED, CLOSE JOINTING, JO INTS IRON=STAINED + OXIDIZED, INDETERMINATE HE SEE NOTE 102

5.0 FT.   7x.7 P/C
FROM 99.0 FT. TO 102 .0 FT. AS ABOVE. CORE I N FAIR CONDITION 0.1 TO SEE NOTE 103

7.9

TUFF, AGGLOMERATIC, RM=2, MEDIUM SOFT ROCK, TO RM=3, MEDIUM HARD ROCK, MODERATE STRENGT H, MODERATE JOINTING, SOME JOINTS CONTAIN THIN

86.7 P/C
FROM 102.0 FT. TO 106 .6 FT. AS ABOVE. CORE I N GOOD CONDITION 0.1 TO

61.6
62.9

72.2

82.0
8.4
86.9
9.1
92.3

99.0

10.1
102.0

215.5

208.8

205.8

A26

CALCITE FILMS, THIN BEDDING. BEDS DIP C7
DEGREES, MEDIUM-GRAINED, WATER-LAID, TUFFAC
SEE NOTE 104

TUFF, RM=2, MEDIUM SOFT ROCK, TO RM=3, MEDI
UM HARD ROCK. MODERATE STRENGTH. CLOSE JOINTI
NG, WITH WAVY SLICKENSIDES. JOINTS CONTAIN T
SEE NOTE 105

AGGLOMERATE, RM=3, MEDIUM HARD ROCK, TO RM=5,
VERY HARD ROCK, MODERATELY STRONG TO STRONG,
VERY CLOSE TO CLOSE JOINTING, WITH WAVY SLICKE
NSIDES. SOME JOINTS OPEN + OXIDIZED, JOINTS C
ONTAIN CHLORITE, CALCITE, ZEOLITE, INDETERM
INATE BEDDING, ANGULAR TO SUB-ANGULAR, TUFFACEO
US, ANDESITIC, BASALTIC, FRAGMENTS, UP TO
0.8 FT IN DIAMETER, IN A TUFFACEOUS MATRIX,
OF SIMILAR COMPOSITION, ALTERED TO CLAY MINER
ALS, COLOR- MOTTLED MEDIUM + DARK GREY-GREEN
EY, AT TOP MOTTLED YELLOW-BROWN, LIGHT GR
EY, IN LOWER PART, SEE NOTE 12 IN SUMMARY

ANDESITE, RM=4, HARD ROCK, TO RM=5, VERY HARD
ROCK, STRONG, DENSE, CLOSE JOINTING, SOME
JOINTS OPEN + OXIDIZED, JOINTS CONTAIN CHLORI
TE, ZEOLITE, AMYGDALOIDAL, CONTAINS FLOW S
TRUCTURES, COLOR- DARK + MEDIUM GREY,

4.6 FT.   100.0 P/C   2.0 FT. LENGTHS.

FROM 106.6 FT. TO 110
.1 FT. AS ABOVE. CORE I
N GOOD CONDITION 0.1 TO
SEE NOTE 106

3.3 FT.   90.3 P/C

FROM 110.1 FT. TO 113
.0 FT. AS ABOVE. DIAMON
D BIT + WATER. CORE IN GO
OD CONDITION 0.1 TO
.7 FT. LENGTHS.----FROM
113.0 FT. TO 125.0
FT. AS ABOVE. CARBOLOY B
IT + WATER, CORE IN GOOD
CONDITION 0.1 TO 1.2
FT. LENGTHS.

1.7 FT.   98.7 P/C

FROM 125.0 FT. TO 157
.0 FT. DRILLED SLOWLY WIT
H .4 X 5-1/2 IN-DOUBLE T
UBE, CARBOLOY BIT + WATER
, CORE IN GOOD CONDITION
0.1 TO 1.1 FT. LENG
TMS.

9.8
1.0
1.9
2.7
8.5
1.2
9.8
4.3
1.3

4.9	1.6		

TUFF, AGGLOMERATIC, RM=2, MEDIUM SOFT ROCK, TO RM=3, MEDIUM HARD ROCK, WEAK TO MODERATE SEE NOTE 107

28.4 FT. 88.8 P/C
FROM 157.8 FT. TO 160.2 FT. DRILLED RAPIDLY + SEE NOTE 108

TUFF, RM=1, SOFT ROCK, TO RM=2, MEDIUM SOFT ROCK, WEAK, CLOSE JOINTING, WITH PLANAR + WAVY SLICKENSIDES, THIN BEDDING, FINE-TO MEDIUM GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC DEBRIS, CONTAINS SCATTERED AGGLOMERATIC MATERIAL, HIGHLY ALTERED TO CLAY MINERALS, COLOR= DARK RED-BROWN, NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO AIR. NOTE/ UPPER CONTACT IS AN OLD EROSION SURFACE.

2.2 FT. 100.0 P/C
FROM 160.2 FT. TO 170.0 FT. AS ABOVE. CORE IN GOOD CONDITION 0.1 TO 1.1 FT. LENGTHS.

9.8

ANDESITE, RM=4, HARD ROCK, TO RM=5, VERY HARD ROCK, STRONG, CLOSE T, MODERATE JOINTING, SOME SLICKENSIDING, JOINTS CONTAIN CHLORITE, ZEOLITE, CALCITE, QUARTZ, CONTAINS FLOW STRUCTURES, AMYGDALOIDAL, AMYGDULES CONTAIN CHLORITE, ZEOLITE, CALCITE, COLOR= MOTTLED MEDIUM GREY, + PURPLISH GREY, NOTE/ LOWER CONTACT IS SHARP.

9.8 FT. 100.0 P/C
FROM 170.0 FT. TO 186.6 FT. DRILLED SLOWLY WITH 4 X 5-1/2 IN. DOUBLE TUBE, CARBOLOY BIT + WATER, CORE IN GOOD CONDITION 0.1 TO 1.8 FT. LENGTHS.---FROM 186.6 FT. TO 192.2 FT. DRILLED SLOWLY WITH 4 X 5-1/2 IN. DOUBLE TUBE, DIAMOND BIT + WATER, CORE IN GOOD CONDITION 0.1 TO 1.0 FT. LENGTHS.

10.1

9.5 0.6 2.2

149.5
151.1
155.4
157.0   150.8
160.2   157.6
164.2
170.0   137.8
174.3
183.8
184.4
186.6

A28

115.6 192.2

AGGLOMERATE, TUFFACEOUS, RM=3, MEDIUM HARD RO
CK, TO RM=4, HARD ROCK, MODERATELY STRONG TO
STRONG. CLOSE TO MODERATE JOINTING, WITH WAV
Y SLICKENSIDES, INDETERMINATE BEDDING, COARSE
SEE NOTE 109

20.2 FT.   100.0 P/C
FROM 192.2 FT. TO 195
.8 FT. DRILLED RAPIDLY +
EASILY WITH 4 X 5-1/2 IN
. DOUBLE TUBE, DIAMOND BI
SEE NOTE 110   9.2

112.0 195.8

TUFF, AGGLOMERATIC, RM=2, MEDIUM SOFT ROCK,
TO RM=3, MEDIUM HARD ROCK, WEAK TO MODERATE
STRENGTH, CLOSE JOINTING, HIGHLY SLICKENSIDE
D, THIN BEDDING, FINE-TO COARSE-GRAINED, MA
TERIAL, TUFFACEOUS, VOLCANIC DEBRIS. CONT
AINS SCATTERED FINE AGGLOMERATIC MATERIAL, AL
TERED TO CLAY MINERALS, CONTAINS EUHEDRAL ESSE
NTIAL + BROKEN ACCIDENTAL FELDSPAR CRYSTALS. CO
LOR= DARK RED=BROWN, NOTE/ CORE HYDRATES, SWE
LLS + DISINTEGRATES ON EXPOSURE TO AIR. NOTE/
UPPER CONTACT IS AN OLD EROSION SURFACE.

3.6 FT.   100.0 P/C
FROM 195.8 FT. TO 198
.8 FT. DRILLED RAPIDLY +
EASILY WITH 4 X 5-1/2 IN
. DOUBLE TUBE, DIAMOND BI
T + WATER, CORE IN GOOD C
ONDITION 0.1 TO 1.8
FT. LENGTHS.----FROM 1   3.0
98.8 FT. TO 20.6 FT.
DRILLED RAPIDLY + EASILY W
ITH 4 X 5-1/2 IN. DOUBLE
TUBE, CARBOLOY BIT + DRI
LLING MUD, CORE IN GOOD C
ONDITION 0.1 TO 1.0
FT. LENGTHS.----FROM 2   5.8
0.6 FT. TO 210.7 FT.
DRILLED SLOWLY + DIFFICULT
LY WITH 4 X 5-1/2 IN. DO
UBLE TUBE, CARBOLOY BIT +
DRILLING MUD, CORE IN FA
IR CONDITION 0.1 TO 0
SEE NOTE 111

198.8 200.6

97.1   210.7

ASH FLOW, RM=4, HARD ROCK, TO RM=5, VERY HARD
ROCK, STRONG, CLOSE TO MODERATE JOINTING,
WITH WAVY SLICKENSIDES, MASSIVE BEDDING, ANGU
LAR TO SUB-ROUNDED, TUFFACEOUS, AGGLOMERATIC
AN IGNIMBRITE, APPARENTLY DEPOSITED IN A SE
MI=MOLTEN CONDITION, WELDED TOGETHER BY OWN HEAT
COLOR= MOTTLED PINKISH GREY, + PURPLI
SM GREY. SEE NOTE 12 IN SUMMARY

211.9
212.3

10.9 FT.   100.0 P/C
FROM 210.7 FT. TO 219
.8 FT. DRILLED RAPIDLY +
EASILY WITH 4 X 5-1/2 IN
. DOUBLE TUBE, CARBOLOY B
IT + DRILLING MUD, CORE I   7.3
N GOOD CONDITION 0.1 TO
2.0 FT. LENGTHS.----FROM   0.4
219.5 FT. TO 222
.0 FT. DRILLED SLOWLY + D
IFFICULTLY WITH 4 X 5-1/
2 IN. DOUBLE TUBE, CARBOL
OY BIT + DRILLING MUD, CO
RE IN FAIR CONDITION 0.1
TO 0.3 FT. LENGTHS.--
----FROM 222.0 FT. TO
230.5 FT. DRILLED RAPIDL
Y + EASILY WITH 4 X 5-1/   9.0
2 IN. DOUBLE TUBE, CARBOL
OY BIT + DRILLING MUD, CO
RE IN POOR CONDITION 0.1
TO 0.8 FT. LENGTHS.----   1.5
--FROM 230.5 FT. TO 2
33.5 FT. DRILLED RAPIDLY
+ EASILY WITH 4 X 5-1/2
IN. DOUBLE TUBE, CARBOLOY
BIT + DRILLING MUD, CORE
IN GOOD CONDITION 0.1
TO 0.9 FT. LENGTHS.   6.7

221.3
222.8

230.5

A29

21.8 FT.   95.7 P/C

4.0
1.6
8.7
3.9
10.1
3.2
1.1
4.2
2.8

ANDESITE, RM-3, MEDIUM HARD ROCK, TO RMS, VERY HARD ROCK, STRONG, DENSE, CLOSE JOINTING, WITH WAVY SLICKENSIDES, JOINTS CONTAIN CHLORITE, ZEOLITE, CALCITE, AMYGDALOIDAL, IN UPPER PART, PARTIALLY ALTERED TO CLAY MINERAL, AMYGDULES CONTAIN CHLORITE ZEOLITE, CALCITE, HARDNESS INCREASES WITH DEPTH, COLOR- MOTTLED GREY, SEE NOTE 12 IN SUMMARY

FROM 233.5 FT. TO 300.2 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN. DOUBLE TUBE, CORE IN GOOD CONDITION, 0.1 TO 3.5 FT. LENGTHS------FROM 233.5 FT. TO 248.3 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN. DOUBLE TUBE, CARBOLOY BIT + WATER, ------FROM 248.3 FT. TO 272.1 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN. DOUBLE TUBE, CARBOLOY BIT + DRILLING MUD, ------FROM 272.1 FT. TO 300.2 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN. DOUBLE TUBE, DIAMOND BIT + DRILLING MUD)

233.5
236.7
238.3
248.3
252.2
262.3
266.0
267.1
271.3
272.1

74.3

A30

NOTES

1. TYPE OF MATERIAL

ELEVATION	DEPTH	
307.8 TO 281.5	0.0 TO 26.3	SILT, CLAY,
281.5 TO 261.0	26.3 TO 46.8	ANDESITE,
261.0 TO 247.5	46.8 TO 60.3	CLAY, SANDY
247.5 TO 215.5	60.3 TO 92.3	AGGLOMERATE,
215.5 TO 208.8	92.3 TO 99.0	TUFF,
208.8 TO 205.8	99.0 TO 102.0	TUFF, AGGLOMERATIC,
205.8 TO 201.2	102.0 TO 106.6	TUFF, AGGLOMERATIC,
201.2 TO 197.7	106.6 TO 110.1	TUFF,
197.7 TO 182.8	110.1 TO 125.0	AGGLOMERATE,
182.8 TO 150.8	125.0 TO 157.0	ANDESITE,
150.8 TO 147.6	157.0 TO 160.2	TUFF, AGGLOMERATIC,
147.6 TO 137.8	160.2 TO 170.0	TUFF,
137.8 TO 115.6	170.0 TO 192.2	ANDESITE,
115.6 TO 112.0	192.2 TO 195.8	AGGLOMERATE, TUFFACEOUS,

6.9   9.1   8.1

94.1 P/C

62.7 FT.

BOTTOM OF HOLE

283.0   292.1   300.2

7.6

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112.0 TO 97.1   198.8 TO 210.7   TUFF, AGGLOMERATIC
 97.1 TO 74.3   210.7 TO 233.5   ASH FLOW
 74.3 TO 7.6   233.5 TO 300.2   ANDESITE
  7.6   300.2   BOTTOM OF HOLE

2. ENGINEERING + GEOLOGICAL FORMATION CONTACTS

ELEVATION		DEPTH		
307.8 TO	247.5	0.0 TO	60.3	OVERBURDEN
247.5 TO	205.8	60.3 TO	102.0	WEATHERED ROCK
205.8 TO	7.6	102.0 TO	300.2	SOUND ROCK
307.8 TO	7.6	0.0 TO	300.2	LAS CASCADAS FM.

4. AMOUNT OF PIPE OR CASING LEFT IN HOLE

300.2 FT. OF PVC,2" PLASTIC PIPE INSTALLED

5. PURPOSE OF HOLE / GEOLOGIC EXPLORATION + SAMPLING.

8. WATER TABLE

ELEVATION	DEPTH	DATE
269.2	38.6	2/ 3/75
267.6	40.2	3/ 3/75
276.0	31.8	4/ 3/75
271.6	36.2	6/ 3/75
266.6	41.2	7/ 3/75
265.2	42.6	8/ 3/75
265.2	42.6	10/ 3/75
262.9	44.9	11/ 3/75
246.1	61.7	12/ 3/75
246.1	61.7	13/ 3/75
265.9	41.9	17/ 3/75
266.2	41.6	18/ 3/75
264.8	43.0	19/ 3/75
263.3	44.5	20/ 3/75
261.8	46.0	21/ 3/75

9. THE FOLLOWING SAMPLES WERE TAKEN FOR LABORATORY TESTING PURPOSES

FROM   TO

56.6   57.9
59.4   60.2
164.4   165.3
166.6   167.1
209.8   210.3
236.7   237.9

10. CORE BOX NUMBERS AND DEPTHS

1) 0.0 7.3	2) 7.3 13.0	3) 13.0 19.2	4) 19.2 2..6	5) 2..6 29.2
6) 29.2 3..3	7) 3..3 41.0	8) 41.0 48.3	9) 48.3 57.0	10) 57.0 61.6
11) 61.6 65.9	12) 65.9 70.2	13) 70.2 7..3	14) 7..3 79.0	15) 79.0 83.0
16) 83.0 86.9	17) 86.9 92.3	18) 92.3 98.7	19) 98.7 103.0	20) 103.0 106.0
21) 108.0 113.0	22) 113.0 117.4	23) 117.4 122.0	24) 122.0 127.2	25) 127.2 132.0
26) 132.0 136.1	27) 136.1 141.2	28) 141.2 146.0	29) 146.0 151.1	30) 151.1 155.0
31) 155.0 160.0	32) 160.0 164.2	33) 164.2 169.3	34) 169.3 174.3	35) 174.3 178.2
36) 178.2 183.8	37) 183.8 187.2	38) 187.2 192.2	39) 192.2 197.2	40) 197.2 202.4
41) 202.4 207.4	42) 207.4 211.9	43) 211.9 213.8	44) 213.8 219.5	45) 219.5 222.8
46) 222.8 227.0	47) 227.0 233.0	48) 233.0 237.0	49) 237.0 242.0	50) 242.0 246.2
51) 246.2 251.8	52) 251.8 256.9	53) 256.9 262.0	54) 262.0 266.0	55) 266.0 271.7
56) 271.7 276.8	57) 276.8 280.5	58) 280.5 284.2	59) 284.2 287.6	60) 287.6 292.1
61) 292.1 297.0	62) 297.0 300.2			

12. ADDITIONAL DESCRIPTIVE INFORMATION

ANDESITE, DEPTH 26.3'-46.8', HAS A HIGHLY ALTERED ZONE, .H=2, MEDIUM SOFT, FROM 37.5'-46.8'. CLAY + SILT, 46.8'-60.3', HAS A VERY HIGH WATER CONTENT FROM 48.3'-65.0', IS ALSO SILTY AT TOP. AGGLOMERATE, 60.3'-92.3', IS ALTERED + SOFTER IN UPPER 2.0', HAS AT OPEN JOINT, 77.7'-79.0'. HAS A SHEAR ZONE, 73.3'-74.3' + THE LOWER 1.0' IS SHEARED. TUFF, 92.3'-99.0'. THE LOWER 4.0' ARE A SHEAR ZONE, FRAGMENTS ONLY RECOVERED.

AGGLOMERATE, 110.1'-125.0', IS BROKEN + SHEARED, 112.0'-115.7'. + HAS AN OPEN, OXIDIZED SHEAR ZONE, 112.0'-112.8', THE LOWER CONTACT IS IN THE SHEAR ZONE. ANDESITE, 125.0'-157.', IS VERY CLOSELY SHEARED, 138.0'-142.8', IS SHEARED WITH SOME GOUGE, 137.5'-138.0', + FROM 155.0'-156.2' THE CORE IS ALTERED, OXIDIZED, MEDIUM PINKISH GREY + LIGHT GREY.

TUFF, AGGLOMERATIC, 157.0'-160.2', THE UPPER PART APPEARS REWORKED + BAKED BY CONTACT WITH ANDESITE ABOVE. TUFF, 160.2'-170.0', HAS SHEAR ZONES WITH SOFT, PLASTIC GOUGE, 161.3'-163.2', + 146.5'-168.5'. TUFF, AGGLOMERATIC, 195.8'-210.7', HAS A FAULT ZONE WITH SOFT, MYLONITIC GOUGE FROM 2.7.0-210.7'.

ASH FLOW, 210.7'-233.5', IS PERLITIC IN LOWER 1.0', HAS A FAULT ZONE, 219.5'-222.0', WITH WAVY SLICKENSIDES + CHLORITE + MED TUFF THAT HAS BEEN FAULTED IN PLACE, + ANOTHER FAULT, 233.0'-233.5', WITH SLICKENSIDES + PERLITIC AGGLOMERATE FAULTED INTO PLACE. ANDESITE, 233.5'-3.0.2', CORE IS BADLY BROKEN, 263.6'-266.0', 270.0'-271.3' + 276.8-293.0', MATERIAL IS SHEARED, 297.0-30.2'.

BEGINNING ON 8 MAR. 1975, DRILLER FILLED HOLE WITH WATER EACH EVENING + TOOK WATER TABLE READING, AS USUAL, EACH MORNING. DRILLER NOTED FLOWING WATER IN HOLE ON 13 MAR. AT 61.7' DEPTH.

13. ADDITIONAL DRILLING INFORMATION

HOLE CAVED BADLY + WAS GROUTED; 0:0'-84.4' DEPTH.

100. IN FAIR CONDITION 0:1 TO 0.4 FT. LENGTHS.-----FROM 44.7 FT. TO 46.8 FT. DRILLED DRY WITH 4'' CASING. CORE IN DISTURBED CONDITION.

101. / CORE HYDRATES; SWELLS + DISINTEGRATES ON EXPOSURE TO AIR.

102. ODING, FINE-TO MEDIUM-GRAINED, TUFFACEOUS, VOLCANIC DEBRIS, CONTAINS SCATTERED AGGLOMERATIC MATERIAL, ALTERED TO CLAY MINERALS, COLOR= MOTLED PINKISH GREY, + LIGHT + MEDIUM NOTE/ CORE HYDRATES; SWELLS + DISINTEGRATES ON EXPOSURE TO AIR.

103. 0.4 FT. LENGTHS.

104. EOUS, VOLCANIC DEBRIS, CONTAINS ABUNDANT AGGLOMERATIC MATERIAL, ALTERED TO CLAY MINERALS, COLOR= MOTTLED LIGHT + MEDIUM GREY-GREEN, + BLUE-GREY, LOWER CONTACT IS GRADATIONAL. NOTE/ CORE HYDRATES; SWELLS + DISINTEGRATES ON EXPOSURE TO AIR.

105. MIN CALCITE FILMS, THIN BEDDING, BEDS DIP 07 DEGREES, MEDIUM-GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC DEBRIS, ALTERED TO CLAY MINERALS, COLOR= MEDIUM GREY-GREEN, NOTE/ CORE HYDRATE S; SWELLS + DISINTEGRATES ON EXPOSURE TO AIR.

106. 1.4 FT. LENGTHS.

107. STRENGTH, CLOSE JOINTING, THIN BEDDING, FINE-TO COARSE-GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC DEBRIS, CONTAINS SCATTERED FINE AGGLOMERATIC MATERIAL, ALTERED TO CLAY MINERALS, COLO R- MOTTLED DARK RED-BROWN, + MEDIUM BLUE-GREEN, NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO AIR. NOTE/ LOWER CONTACT IS SHARP. SEE NOTE 12 IN SUMMARY

108. EASILY WITH 4 X 5-1/2 IN. DOUBLE TUBE, CARBOLOY BIT + WATER, CORE IN GOOD CONDITION 0.1 TO 0.6 FT. LENGTHS.

109. -GRAINED, TUFFACEOUS, ANDESITIC, FRAGMENTS, UP TO 0.3 FT. IN DIAMETER, IN A TUFFACEOUS MATRIX , OF SIMILAR COMPOSITION, PARTIALLY ALTERED TO CLAY MINERALS, FINER GRAINED IN UPPER PART BECO MING COARSER WITH DEPTH, COLOR- MOTTLED LIGHT MEDIUM + DARK GREY, RED-BROWN, + PURPLISH G REY.

110. T + WATER, CORE IN GOOD CONDITION 0.1 TO 1.0 FT. LENGTHS.

111. .7 FT. LENGTHS.

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PANAMA CANAL COMPANY

ENGINEERING AND CONSTRUCTION BUREAU

GEOLOGICAL FIELD LOG

1 INCH=4 FT.

PROJECT / LA PITA HILL STUDIES FOR WES

LOCATION / CUNETTE REACH EAST

COMPLETION DATE / 11 APR. 1975

CORE RECOVERY / 281.4 FT.   93.5 P/C

DRILLER / C. DRAKE

HOLE NO. / ERE = 27   GEOLOGIST / J. L. STEWART

LATITUDE N. / 9 41' + 1873   LONGITUDE N. / 79 40' + 1808

STATION / 1829+22   OFFSET / 803' E

GROUND ELEVATION / 318.3   HOLE DEPTH / 301.2 FT.

VERTICAL HOLE

ELEVATION IN FEET	DEPTH IN FEET	COLUMNAR SECTION	DESCRIPTION OF MATERIAL	DRILLING CHARACTERISTICS	CORE RECOVERY
312.3	0.0		SILT, CLAY, OM=2, MEDIUM SOFT OVERBURDEN, TO OM=3, MEDIUM HARD OVERBURDEN, WEAK, MODE RATE PLASTICITY, LOW DRY STRENGTH, MODERATE W ATER CONTENT, RESIDUAL SAPROLITIC, SILT, CLAY, DERIVED FROM AGGLOMERATE, BY NORMAL WE ATHERING PROCESSES, COLOR= MOTTLED MEDIUM RE D=BROWN, YELLOW=BROWN, GREY=GREEN, BROWN, + GREY,	FROM 0.0 FT. TO 12 .8 FT. DRILLED DRY WITH 4.1' CASING, CORE IN DIST URBED CONDITION. M.P.300 TO 525 PSI.	
	5.0				1.6
	8.6				3.5
	12.2			8.6 FT. 70.5 P/C	3.5
	15.8		SILT, CLAY, PEBBLES, COBBLES, OM=2, MEDIUM SOFT OVERBURDEN, TO OM=3, VERY HARD OVERBURD EN, WEAK TO MODERATE STRENGTH, LOW TO MODERAT E PLASTICITY, LOW TO MODERATE DRY STRENGTH, LOW TO MODERATE WATER CONTENT, RESIDUAL SAPROL ITIC, SILT, CLAY, PEBBLES + COBBLES, DERI VED FROM ANDESITE, BY NORMAL WEATHERING PROCE SSES, COLOR= MOTTLED RED=BROWN, + GREY, SEE NOTE 12 IN SUMMARY	FROM 12.2 FT. TO 38 .9 FT. AS ABOVE. CORE I N DISTURBED CONDITION. M4 P.550 TO 800 PSI.	2.7
300.1	19.6				2.7

SILT, OM-3, MEDIUM HARD OVERBURDEN, TO OM-4, HARD OVERBURDEN, WEAK TO MODERATE STRENGTH, LOW PLASTICITY, LOW DRY STRENGTH, MODERATE WATER CONTENT, RESIDUAL, SAPROLITIC, SILT, DERIVED FROM ANDESITE, BY NORMAL WEATHERING PROCESSES, COLOR= MOTTLED LIGHT GREY, MEDIUM BROWN, + YELLOW-BROWN,

19.6 FT.   75.7 P/C

FROM 38.1 FT. TO 68.5 FT. AS ABOVE, CORE IN DISTURBED CONDITION, M= P=400 TO 725 PSI.

0.9 1.3 2.3 2.2 3.2 3.1 2.8 2.1 3.4 3.5 3.5 3.4 3.5

21.9 24.3 27.8 31.3 34.6 38.1 41.6 44.5 48.0 51.5 55.0 58.5 62.0

27.2

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65.5		3.2
68.5	28.4 FT. 93.5 P/C	3.0
72.0	TUFF, AGGLOMERATIC, QM=3, MEDIUM HARD OVERBU RDEN, TO RM=2, MEDIUM SOFT ROCK, MODERATE S TRENGTH, HIGHLY WEATHERED, VERY CLOSE JOINTIN G, JOINTS IRON-STAINED + OXIDIZED, JOINTS CON TAIN ABUNDANT SOFTER, SOIL-LIKE MATERIAL, JOINT BLOCK CENTERS ARE HARDER + LESS WEATHERED, INDETE RMINATE BEDDING, FINE-GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC DEBRIS, FRAGMENTS AGGL OMERATIC MATERIAL, HIGHLY ALTERED TO CLAY MIN ERALS, WEATHERING DECREASES + HARDNESS INCREASE S WITH DEPTH. COLOR- MOTTLED DARK + MEDIUM GREY-BROWN, + GREY, IN UPPER PART, GRADIN G TO MOTTLED MEDIUM BROWN, GREY-GREEN, + GREY, IN LOWER PART	3.2
75.5	FROM 68.5 FT. TO 81 .8 FT. AS ABOVE. CORE I N DISTURBED CONDITION. MJ P=900 TO 999 PSI.--- =FROM 81.8 FT. TO 98.2 FT. DRILLED RAPIDLY + EASILY WITH 4 X 51/2 IN. DOUBLE TUBE, CARBOLOY BIT + DRILLING MUD, CORE IN GOOD CONDITION. 0.1 TO 1.0 FT. LENGTHS.	3.2
78.7		3.2
81.8		
243.8		3.1
91.8		
92.2	22.2 FT. 89.5 P/C	8.2
95.4	TUFF, QM=5, VERY HARD OVERBURDEN, TO RM=3, MEDIUM HARD ROCK, WEAK TO MODERATE STRENGTH, WEATHERED, CLOSE JOINTING, JOINTS IRON-STAINE D + OXIDIZED, JOINTS CONTAIN CALCITE, ZEOLIT E, MASSIVE BEDDING, FINE-TO MEDIUM-GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC DEBRIS, CO NTAINS SCATTERED AGGLOMERATIC MATERIAL, ALTERE D TO CLAY MINERALS, COLOR- DARK GREY-GREEN, NOTE/ CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSURE TO AIR. NOTE/ LOWER CONTACT IS SHARP	2.8
220.1	FROM 92.2 FT. TO 101 .0 FT. DRILLED RAPIDLY + EASILY WITH 4 X 5-1/2 IN . DOUBLE TUBE, CARBOLOY B IT + DRILLING MUD, CORE I N GOOD CONDITION. 0.1 TO 1.9 FT. LENGTHS.	
101.0	8.1 FT. 92.1 P/C	9.8
105.2	FAULT ZONE, QM=5, VERY HARD OVERBURDEN, TO R M=5, VERY HARD ROCK, WEAK, WEATHERED, VERY C LOSE JOINTING, SLICKENSIDED, JOINTS IRON-STAI NED + OXIDIZED, JOINTS OPEN, CHLORITIC, TUFF ACEOUS, ANDESITIC, AGGLOMERATIC, FRAGMENTS, ALTERED TO CLAY MINERALS, WEATHERING DECREAS ES + HARDNESS INCREASES WITH DEPTH. COLOR- MO TTLED GREY-GREEN, GREY, LIGHT GREY, + GREY-BROWN, SEE NOTE 12 IN SUMMARY	
211.3	FROM 101.0 FT. TO 129 .5 FT. AS ABOVE. CORE I N GOOD CONDITION. 0.1 TO 2.0 FT. LENGTHS.	

A38

5.3

9.0

5.8

6.7

7.3

9.4

20.5 FT.   93.0 P/C

FROM 129.5 FT. TO 143
.8 FT. AS ABOVE. CORE I
N GOOD CONDITION 0.1 TO
1.7 FT. LENGTHS.

TUFF, RM=2, MEDIUM SOFT ROCK, TO RM=3, MEDI
UM HARD ROCK, WEAK, VERY CLOSE TO CLOSE JOIN
TING, WITH WAVY SLICKENSIDES, SOME JOINTS CO
NTAIN CALCITE, THIN BEDDING, CROSS=BEDDED,
BEDS DIP 16 DEGREES, FINE-TO MEDIUM=GRAINED
, WATER=LAID, TUFFACEOUS, VOLCANIC DEBRIS,
CONTAINS SCATTERED AGGLOMERATIC MATERIAL, AL
TERED TO CLAY MINERALS, COLOR= DARK RED=BROW
N, AT TOP DARK GREY=GREEN, AT BASE NOTE/
CORE HYDRATES, SWELLS + DISINTEGRATES ON EXPOSUR
E TO AIR. NOTE/ LOWER CONTACT IS SHARP.

13.9 FT.   100.0 P/C

FROM 143.5 FT. TO 158
.8 FT. AS ABOVE. CORE I
N GOOD CONDITION 0.1 TO
2.2 FT. LENGTHS.

ANDESITE, AMYGDALOIDAL, RM=4, HARD ROCK, TO
RM=5, VERY HARD ROCK, STRONG, MODERATE JOINT
ING, WITH WAVY SLICKENSIDES, JOINTS CONTAIN
CHLORITE, ZEOLITE, CALCITE, FINE=TO MEDIUM-G
RAINED, AMYGDALOIDAL, AMYGDULES CONTAIN CH
LORITE, ZEOLITE, QUARTZ, BECOMES FINER WITH D
EPTH, COLOR= MOTTLED GREY, NOTE/ LOWER CO
NTACT IS SHARP.

110.8

120.6

127.3

129.5

134.0

141.3

143.4

151.3

142.8

168.9

9.0

8.9

5.8

9.0

2.8

5.7

1.2 FT. 96.0 P/C

FROM 158.2 FT. TO 172
.8 FT. AS ABOVE. CORE I
N GOOD CONDITION 0.1 TO
3.4 FT. LENGTHS.

TUFF, AGGLOMERATIC, RH=3, MEDIUM HARD ROCK,
TO RH=4, HARD ROCK, MODERATE STRENGTH, CLOS
E TO MODERATE JOINTING, WITH WAVY SLICKENSIDES
, MODERATE BEDDING. BEDS DIP 17 TO 20 DE
GREES. MEDIUM TO COARSE-GRAINED, WATER-LAID,
TUFFACEOUS, VOLCANIC DEBRIS, CONTAINS ABUND
ANT AGGLOMERATIC MATERIAL, SCATTERED AGGLOM
ERATIC LAYERS, ALTERED TO CLAY MINERALS, COLO
R= MOTTLED DARK + MEDIUM GREY, IN UPPER PAR
T GRADING TO MOTTLED RED-BROWN, + GREY,
IN LOWER PART NOTE/ CORE HYDRATES, SMELLS +
DISINTEGRATES ON EXPOSURE TO AIR. NOTE/ LOWER
CONTACT IS SHARP. SEE NOTE 12 IN SUMMARY

13.0 FT. 92.9 P/C

FROM 172.2 FT. TO 176
.0 FT. AS ABOVE. CORE I
N GOOD CONDITION 0.1 TO
1.3 FT. LENGTHS.
FROM 176.0 FT. TO 183
.5 FT. AS ABOVE. DIAMON
D BIT + DRILLING MUD, CO
RE IN GOOD CONDITION 0.1
TO 1.0 FT. LENGTHS.

AGGLOMERATE, RH=4, HARD ROCK, TO RH=5, VERY HA
RD ROCK, STRONG, CLOSE TO MODERATE JOINTING,
JOINTS CONTAIN CALCITE, MODERATE BEDDING,
BEDS DIP 20 DEGREES, SUBANGULAR TO WELL ROUND
ED, ANDESITIC, BASALTIC, FRAGMENTS, UP TO
0.5 FT. IN DIAMETER, IN A COARSE-GRAINED, TUFFA
CEOUS MATRIX OF SIMILAR COMPOSITION, BECOME
S FINER GRAINED + MORE TUFFACEOUS AT BASE. COLO
R= MOTTLED LIGHT + MEDIUM + DARK GREY, GREY
+GREEN, + BLACK.

11.3 FT. 100.0 P/C

FROM 183.5 FT. TO 185
.3 FT. AS ABOVE. DIAMON
D BIT + DRILLING MUD, CO
RE IN GOOD CONDITION 0.1
TO 0.8 FT. LENGTHS.
FROM 185.3 FT. TO
189.9 FT. AS ABOVE. CA
RBOLOY BIT + DRILLING MUD,
SEE NOTE 101

TUFF, RH=1, SOFT ROCK, TO RH=2, MEDIUM SOFT
ROCK, WEAK, CLOSE JOINTING, WITH PLANAR +
WAVY SLICKENSIDES, INDETERMINATE BEDDING, FINE
-GRAINED, WATER-LAID, TUFFACEOUS, VOLCANIC
DEBRIS, CONTAINS SCATTERED AGGLOMERATIC MATER
IAL, HIGHLY ALTERED TO CLAY MINERALS, COLOR=
DARK RED, NOTE/ CORE HYDRATES, SMELLS + DISI
NTEGRATES ON EXPOSURE TO AIR. NOTE/ LOWER CONT
SEE NOTE 100

6.1 FT. 95.4 P/C

FROM 189.9 FT. TO 199
.0 FT. AS ABOVE. CARBOL
OY BIT + DRILLING MUD, CO
RE IN GOOD CONDITION 0.1
TO 1.2 FT. LENGTHS.

AGGLOMERATE, AGGLOMERATIC, RH=2, MEDIUM SOFT
ROCK, TO RH=3, MEDIUM HARD ROCK, WEAK TO MO
DERATE STRENGTH, CLOSE TO MODERATE JOINTING,
JOINTS CONTAIN CALCITE, ZEOLITE, CHLORITE,
MASSIVE BEDDING, ANGULAR TO SUBANGULAR, ANDESI
TIC, BASALTIC, FRAGMENTS, IN A TUFFACEOUS MA
TRIX, OF SIMILAR COMPOSITION, HIGHLY ALTERED

158.2
160.3
170.2
172.2
176.0
183.5
185.3
188.1
193.3

15.1
140.1
128.8
122.4

TO CLAY MINERALS. COLOUR= MOTTLED LIGHT GR
EY=GREEN. + MEDIUM PURPLISH GREY. LOWER CONT
ACT IS GRADATIONAL. NOTE/CORE HYDRATES/SWELL
S + DISINTEGRATES ON EXPOSURE TO AIR.

ASH FLOW. RH=5. VERY HARD ROCK. STRONG. CL
OSE JOINTING. WITH WAVY SLICKENSIDES. JOINTS
CONTAIN CHLORITE. ZEOLITE/ CALCITE. MASSIV
E BEDDING. PERLITIC. ANDESITIC. BASALTIC.
FRAGMENTS. IN A TUFFACEOUS MATRIX. OF SIMILAR
COMPOSITION. AN IGNIMBRITE. APPARENTLY DEPOS
ITED IN A SEMI-MOLTEN CONDITION. WELDED TOGETHER
BY OWN HEAT. COLOUR= MOTTLED MEDIUM + DARK
GREY. + BLACK. AT TOP GRADING TO BLACK.
MOTTLED WITH DARK GREY. IN LOWER PART. LOWE
R CONTACT IS GRADATIONAL. SEE NOTE 12 IN SUMMA
RY

AGGLOMERATE. RH=3. MEDIUM HARD ROCK. TO RH=4
. HARD ROCK. MODERATELY STRONG TO STRONG. MODE
RATE JOINTING. JOINTS CONTAIN CALCITE. CHLORI
TE. ZEOLITE. MASSIVE BEDDING. ANGULAR TO SUB
=ROUNDED. CHLORITIC. ZEOLITIC. CALCAREOUS.
ANDESITIC. BASALTIC. FRAGMENTS. UP TO 0.8
FT IN DIAMETER. IN A TUFFACEOUS MATRIX. OF S
IMILAR COMPOSITION. COLOUR= MOTTLED LIGHT GR
EY. GREEN. + GREY=GREEN. AT TOP. AT BASE.
MOTTLED DARK. RED=BROWN. DARK + MEDIUM GREE
N. + GREY=GREEN. SEE NOTE 12 IN SUMMARY

8.6 FT.   9.6 P/C
FROM 195.0 FT. TO 224
.5 FT. AS ABOVE. CORE I
N GOOD CONDITION 0.1 TO
2.5 FT. LENGTHS.

29.5 FT.   100.0 P/C
FROM 224.5 FT. TO 298
.5 FT. AS ABOVE. CORE I
N GOOD CONDITION 0.1 TO
2.0 FT. LENGTHS.

10.0

3.8

9.9

9.2

10.0

195.0

204.3

206.1

218.0

224.5

227.2

237.2

113.3

87.8

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BOTTOM OF HOLE

ANDESITE, RM=5, VERY HARD ROCK, STRONG, DE
NSE, CLOSE JOINTING, JOINTS CONTAIN CHLORITE
SEE NOTE 102

79.7 FT.
99.6 P/C
FROM 298.5 FT. TO 301
FT. AS ABOVE. CORE I
SEE NOTE 103
2.7 FT.
100.0 P/C

4.5   7.5   6.9

246.7   29.3   13.8   298.5   11.1   301.2

NOTES

1. TYPE OF MATERIAL

ELEVATION	DEPTH	
312.3 TO 300.1	0.0 TO 12.2	SILT, CLAY,
300.1 TO 272.2	12.2 TO 38.1	SILT, CLAY, PEBBLES, COBBLES,
272.2 TO 243.8	38.1 TO 68.5	SILT,
243.8 TO 220.1	68.5 TO 92.2	TUFF, AGGLOMERATIC,
220.1 TO 211.3	92.2 TO 101.0	TUFF,
211.3 TO 182.8	101.0 TO 129.5	FAULT ZONE,
182.8 TO 168.9	129.5 TO 143.4	TUFF,
168.9 TO 154.1	143.4 TO 158.2	ANDESITE, AMYGDALOIDAL,
154.1 TO 140.1	158.2 TO 172.2	TUFF, AGGLOMERATIC,
140.1 TO 128.2	172.2 TO 183.5	AGGLOMERATE,
128.8 TO 122.4	183.5 TO 189.9	TUFF,
122.4 TO 113.3	189.9 TO 199.0	AGGLOMERATE, AGGLOMERATIC,
113.3 TO 87.8	199.0 TO 224.5	ASH FLOW,
87.8 TO 13.8	224.5 TO 298.5	AGGLOMERATE,
13.8 TO 11.1	298.5 TO 301.2	ANDESITE,
11.1	301.2	BOTTOM OF HOLE

2. ENGINEERING + GEOLOGICAL FORMATION CONTACTS

ELEVATION   DEPTH

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312.3 TO 243.8   0.0 TO 68.5 OVERBURDEN
243.8 TO 182.8 68.5 TO 129.5 WEATHERED ROCK
182.8 TO 312.3 129.5 TO 301.2 SOUND ROCK
312.3 TO   0.0 TO 301.2 LAS CASCADAS FM.

5. PURPOSE OF HOLE / GEOLOGIC EXPLORATION, SAMPLING + PIEZOMETER INSTALLED AT 196.0' DEPTH.

8. WATER TABLE

ELEVATION	DEPTH	DATE
289.6	22.7	27/ 3/75
265.9	46.4	28/ 3/75
289.9	22.4	29/ 3/75
272.6	39.5	31/ 3/75
272.8	39.5	2/ 4/75
279.9	32.4	3/ 4/75
277.6	34.7	4/ 4/75
275.3	37.0	5/ 4/75
277.1	35.2	8/ 4/75
275.0	37.3	10/ 4/75
281.0	31.3	11/ 4/75

9. THE FOLLOWING SAMPLES WERE TAKEN FOR LABORATORY TESTING PURPOSES

FROM	TO
25.8	27.3
40.1	41.1
70.5	71.5
74.5	75.5
76.0	77.0
135.5	136.3
141.4	142.5
185.3	186.5

10. CORE BOX NUMBERS AND DEPTHS

1)	0.0	8.0	2)	8.0	13.1	3)	13.1	19.0	4)	19.0	25.8	5)	25.8	31.3
6)	31.3	37.5	7)	37.5	44.0	8)	44.0	48.8	9)	48.8	53.5	10)	53.5	58.0

11)	58.0	62.5	12)	62.5	67.3	13)	67.3	71.5	14)	71.5	76.0	15)	76.0	80.0
16)	80.0	86.8	17)	86.8	91.8	18)	91.8	97.2	19)	97.2	102.2	20)	102.2	106.6
21)	106.6	111.3	22)	111.3	116.1	23)	116.1	122.0	24)	122.0	127.3	25)	127.3	132.0
26)	132.0	135.4	27)	135.4	141.3	28)	141.3	146.3	29)	146.3	151.3	30)	151.3	155.8
31)	155.8	160.5	32)	160.5	165.3	33)	165.3	170.2	34)	170.2	173.2	35)	173.2	177.9
36)	177.9	182.8	37)	182.8	188.6	38)	188.6	199.3	39)	199.3	199.3	40)	199.3	204.3
41)	204.3	208.1	42)	208.1	213.1	43)	213.1	218.0	44)	218.0	223.0	45)	223.0	227.2
46)	227.2	232.2	47)	232.2	237.2	48)	237.2	242.2	49)	242.2	246.6	50)	246.6	251.5
51)	251.5	256.0	52)	256.0	261.0	53)	261.0	266.0	54)	266.0	270.7	55)	270.7	275.2
56)	275.2	279.7	57)	279.7	283.6	58)	283.6	288.0	59)	288.0	293.0	60)	293.0	297.7
61)	297.7	301.2													

12. ADDITIONAL DESCRIPTIVE INFORMATION

SILT, CLAY, PEBBLES + COBBLES, DEPTH 12.2'-38.1', IS DERIVED FROM AMYGDALOIDAL ANDESITE, THE PEBBLES + COBBLES, WHICH ARE IN THE UPPER + CENTRAL PARTS, ARE THIS ANDESITE, SILT, 38.1'-68.5', IS ALSO DERIVED FROM AMYGDALO IDAL ANDESITE. TUFF, 92.2'-101.0', HAS A JOINT WITH GOUGE AT 99.0'.

FAULT ZONE, 101.0'-129.5', MATERIAL IS BROKEN, 0.1'-0.5', 106.5'-112.9', THERE IS MYLONITIC GOUGE,111.8'-112.9 ', THERE IS A HORSE OF AMYGDALOIDAL ANDESITE, 112.9'-117.7', + SOFT, PLASTIC HIGHLY SLICKENSIDED GOUGE, 119.7 '-126.0'. TUFF, 129.5'-143.4', UPPER 1.0' IS VERY AGGLOMERATIC, A SHEAR ZONE WITH SOFT, PLASTIC GOUGE, 14 1.0'-141.4', + MATERIAL IS GREY-GREEN BELOW 141.4', THERE ARE MANY HORIZONTAL SLICKENSIDES IN THIS MATERIAL.

TUFF, AGGLOMERATIC, 158.2'-172.2', UPPER CONTACT IS AN OLD EROSIONAL SURFACE, + IS BAKED BY IGNEOUS MATERIAL ABOVE, JOINTS HAVE HORIZONTAL SLICKENSIDES, THERE IS SOFT, PLASTIC GOUGE IN A JOINT AT 159.8', + THERE ARE TWO AGGLOMERATIC LAYERS, 166.5'-168.2' + 170.2'-171.3'. AGGLOMERATE, 172.2'-183.5', IS A VOLCANIC CONGLOMERA TE.

TUFF, 183.5'-189.9', THE UPPER CONTACT IS AN OLD EROSIONAL SURFACE, THERE IS A STEEP ANGLE JOINT WITH A PLANAR SLICKENSIDE AT 189.2' + A JOINT OR SHEAR WITH MYLONITE, 189.6'-189.9'. AGGLOMERATE, TUFFACEOUS, 189.9'-1 99.0', HAS OPEN, NEAR VERTICAL JOINTING, 194.3'-199.0'.

ASH FLOW, 199.0'-224.5', HAS A FRAGMENT OF ANDESITE, NOT A DIKE, APPARENTLY DEPOSITED WITH ASH FLOW, 204.8'-20 6.0', HAS NEAR VERTICAL JOINTS, 208.8'-210.7' + 221.0'-224.5', THE PERLITIC CONTENT INCREASES WITH DEPTH BUT T HE LOWER 5.0' ARE PUMICEOUS + LESS PERLITIC.

AGGLOMERATE, 224.5'-298.5', THE UPPER 10.0' CONTAIN NUMEROUS PUMICEOUS, LIGHT COLORED FRAGMENTS + ARE ALSO BRO KEN + SHEARED. THE AGGLOMERATE IS PREDOMINATELY ANDESITIC WITH A VERY SMALL AMOUNT OF BASALT. CORE IS BADLY BROKEN 263.5'-270.0', 273.0'-275.2', 277.5'-279.0' + 290.0'-294.0'.

100. ACT IS SHARP. SEE NOTE 12 IN SUMMARY

101. CORE IN GOOD CONDITION 0.1 TO 1.3 FT. LENGTHS.

102. , ZEOLITE, CALCITE, FINE-GRAINED, CONTAINS FLOW STRUCTURES, COLOR- MEDIUM GREY,

103. N GOOD CONDITION 0.1 TO 1.0 FT. LENGTHS.

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APPENDIX B: LAS CASCADAS FORMATION LABORATORY TEST RESULTS

Route 14, Panama

Summary of sampling and testing

Group number	Geological formation name	Rock type	Boring number	Samples No.	Depth	Laboratory identification number	Scope of testing I=index, P=petrographic analyses UC—unconfined compression
1	Las Cascadas	Agglomerate	D-1	1	79.2-80.0	222/70	I - P - UC
				2	81.7-82.9		
				3	88.2-89.0		
2	Las Cascadas	Tuff	D-1	4	101.0-102.5	222/72	I - UC
				5	105.3-105.8	222/72	P
				6	106.0-107.0		
3	Las Cascadas	Agglomerate	D-1	7	116.5-118.0		
				8	160.1-161.5		
				9	164.5-166.2		
				10	174.9-176.0	222/78	I - P - UC
				11	181.2-182.4		
				12	186.0-187.0		
4	Las Cascadas	Agglomerate	D-1	19	219.0-220.3	222/81	I - P - UC
				13	230.4-231.6	222/81	Slaking - specific gravity.
				14	233.7-234.7		
				17	240.8-241.9		
				18	260.5-262.0		
5	Las Cascadas	Shale	D-1	15	235.5-236.0	222/83	I - P - Residual strength by multi-stage direct shear.
				16	237.8-240.0	222/84	I - Direct shear, residual direct shear. (Re-exam., I, Slaking Study, Supp. 2)

II-1*(REVISED, SUPP. 2)

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ARITHMETICAL GRAPH
Stress Strain Curve

Route 14, Interoceanic Canal Study

Lab. No. 222/70, Group No. 1, Las Cascadas Formation, Agglomerate,

Boring D-1, Sample No. 2, Depth 81.7' - 82.9'

Type Failure

Shear

Unconfined Compressive Strength: 820 psi
Natural Water Content: 11.2%
Solid Unit Weight: 165.4 lbs/ cu.ft.
Potential Drainage Characteristic: Relatively Impervious
No indication of fractures, joints or slickensides.
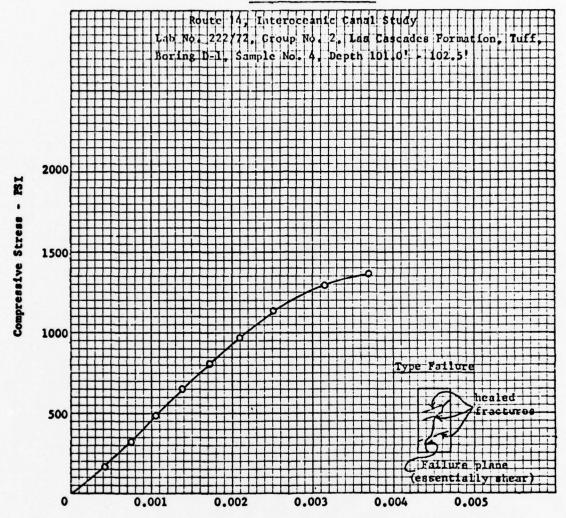
Reqn. No. 08-123-ENG-94-68C

ARITHMETICAL GRAPH   Work Order No. 4880

Stress Strain Curve

Route 14, Interoceanic Canal Study
Lab No. 222/72, Group No. 2, Las Cascades Formation, Tuff,
Boring D-1, Sample No. 4, Depth 101.0' - 102.5'

Type Failure

healed fractures

Failure plane (essentially shear)

Strain - in./in.

Unconfined Compressive Strength: <u>1370 psi</u>
Natural Water Content: <u>12.3%</u>
Solid Unit Weight: <u>159.1 lb/cu.ft.</u>
Potential Drainage Characteristic: <u>Relatively Impervious</u>
No indication of joints or slickensides.
Compressive specimen sheared along a number of healed fractures.
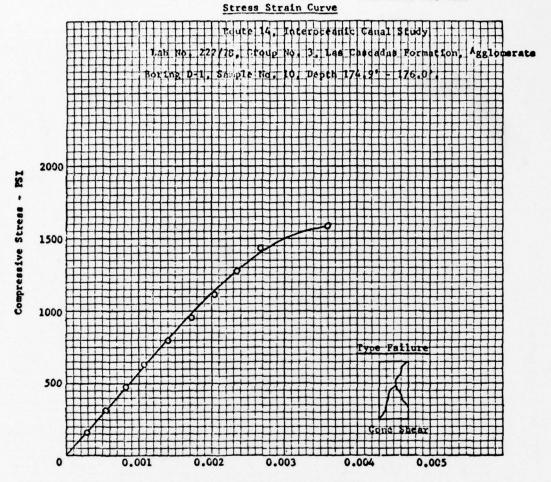
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U. S. ARMY ENGINEER DIVISION, SOUTH ATLANTIC
DIVISION LABORATORY
MARIETTA, GEORGIA

Reqn. No. 08-123-Eng-94-68C
Work Order No. 4880

ARITHMETICAL GRAPH
Stress Strain Curve

Route 14, Interoceanic Canal Study
Lab No. 222/78, Group No. 3, Las Cascadas Formation, Agglomerate
Boring D-1, Sample No. 10, Depth 174.9' - 176.0'.

Compressive Stress - PSI

Strain - in./in.

Type Failure

Cone Shear
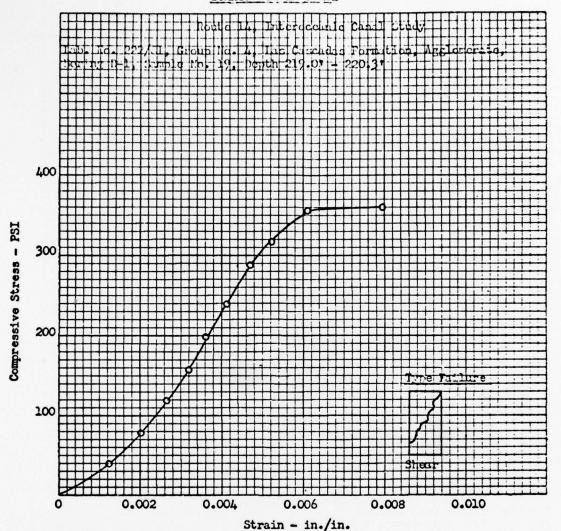
Unconfined Compressive Strength: <u>1580 psi</u>
Natural Water Content: <u>7.1%</u>
Solid Unit Weight: <u>166.6 lb/cu.ft.</u>
Potential Drainage Characteristic: <u>Relatively Impervious</u>
No indication of fractures, joints or slickensides.

ARITHMETICAL GRAPH
STRESS STRAIN CURVE

Req. No. OC-123-ENG-94-68C
Work Order No. 4880

Round 14, Interoceanic Canal Study

Lab. No. 222411, Group No. 14, Las Cascadas Formation, Agglomeratic, Boring D-1, Sample No. 19, Depth 219.0' - 220.3'

Compressive Stress – PSI

Strain – in./in.

Unconfined Compressive Strength: __360 psi__
Natural Water Content: __11.0%__
Solid Unit Weight: __162.9 lb./cu. ft.__
Potential Drainage Characteristic: __Relatively Impervious__
No indication of fractures, joints or slickensides.

Rate of Strain = 0.001 in/min

σ = 4 tsf | σ = 8 tsf | σ = 12 tsf

Shear Stress (T/SF)

0.25" displacement per cycle

Total Displacement (in)

Vertical Def. (in)

Shear Strength Parameters

	Maximum	Ultimate
∅	2.5°	4.5°
Tan ∅	0.044	0.079
c	0.8 tsf	0.2 tsf

Shear Strength (T/SF)

∅ = 2.5°

∅ = 4.5°

Normal Stress (T/SF)

Type of Specimen: Remolded to in-situ density and pre-split; unable to trim from undisturbed sample.

Size of Specimen:	2" x 2" x 0.50"
Water Content, %	18.7
Void Ratio	0.569
Saturation, %	91.7
Dry Density, pcf	111.4
Specific Gravity	2.80

Classification: Red shale — See additional information on Gradation Curve, ENG Form 2087.

Interoceanic Canal Study

Route 14

Residual Strength Test "Multistage" Direct Shear

Boring D-1, Sample 15

Elev. +42.8' to -43.3'

Lab. No. 222/83

FC

23 Jan 68

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DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, P. O. BOX 51, MARIETTA, GEORGIA 30060

SHEAR STRENGTH PARAMETERS

	Maximum	Ultimate
$\phi' =$	24.5	34.0
TAN $\phi' =$	.456	.675
$c' =$	7.90	0.00 T/SQ FT

□ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	4
INITIAL	WATER CONTENT	w_o	14.8 %	16.3%	16.1%	14.9%
	VOID RATIO	e_o	.503	.564	.601	.594
	SATURATION	S_o	83.3 %	81.3%	75.6%	70.8%
	DRY DENSITY, LB/CU FT	γ_d	117.1	112.5	109.9	110.4
	VOID RATIO AFTER CONSOLIDATION	e_c	.410	.477	.456	.489
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	2	2	2	2
FINAL	WATER CONTENT	w_f	17.8 %	18.6%	18.8%	16.7%
	VOID RATIO	e_f	.437	.468	.485	.397
	SATURATION	S_f	100.0%	100.0%	100.0%	100.0%
NORMAL STRESS, T/SQ FT		σ	9.00	10.00	12.00	18.00
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	12.50	13.30	13.20	16.69
ACTUAL TIME TO FAILURE, MIN		t_f	30	120	105	210
RATE OF STRAIN, IN./MIN			.0013	.0014	.0010	.0010
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}	5.54	6.98	8.35	13.10

TYPE OF SPECIMEN **Undisturbed**   2.00 IN. SQUARE   Avg. 0.57 IN. THICK

CLASSIFICATION **Dark brown shale, Las Cascadas Formation.**

LL	50	PL	39	PI	11	D_{10}=.013 mm	G. 2.82

REMARKS **See gradation curve on Eng Form 2087, for further description.**

PROJECT	Interoceanic Canal Study
	Lab No. 222/84
AREA	Route 14
BORING NO. D-1	SAMPLE NO. 16
DEPTH EL -46.1' - 47.3'	DATE 2 Feb. 1968
	DIRECT SHEAR TEST REPORT

ENG FORM 2092
1 JUN 68   (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE   GPO 1966 OF-214 945   PLATE IX-3

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY,
CORPS OF ENGINEERS, P. O. BOX 51, MARIETTA, GEORGIA 30060

See Sheet 2

See Sheet 2

See Sheet 2 for additional data.

Maximum

Ultimate

NORMAL STRESS, σ, T/SQ FT

SHEAR STRESS, τ, T/SQ FT

SHEAR STRENGTH, τ, T/SQ FT

VERTICAL DEFORMATION, IN.

HORIZ. DEFORMATION, IN.

SHEAR STRENGTH PARAMETERS *

	Maximum	Ultimate
ϕ' =	15.5°	15.5°
TAN ϕ' =	.277	.277
c' =	1.80	0.50 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	14.3%	14.5%	15.1%	%
	VOID RATIO	e_o	.403	.407	.413	
	SATURATION	S_o	100.0%	100.0%	100.0%	%
	DRY DENSITY, LB/CU FT	γ_d	125.5	125.1	124.3	
	VOID RATIO AFTER CONSOLIDATION	e_c	.325	.309	.283	
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	1	1	1	
FINAL	WATER CONTENT **	w_f	19.6%	21.8%	18.6%	%
	VOID RATIO	e_f	.273	.272	.213	
	SATURATION	S_f	100.0%	100.0%	100.0%	%
	NORMAL STRESS, T/SQ FT	σ	4.00	8.00	12.00	
	MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	2.97	3.49	5.65	
	ACTUAL TIME TO FAILURE, MIN	t_f	140	240	45	
	RATE OF STRAIN, IN./MIN		.001	.001	.001	
	ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}	1.62	2.70	3.82	

TYPE OF SPECIMEN	Undisturbed - Pre-split	2.00 IN. SQUARE	0.50 IN. THICK

CLASSIFICATION Dark brown shale (see gradation curve for further description).

LL	50	PL	39	PI	11			G. 2.82

REMARKS
1. See gradation curve on ENG Form 2087.
2. *See sheet 2 for additional strength parameters and data.
3. **W_f of material scraped from shear plane.

PROJECT Interoceanic Canal Study

Lab. No. 222/84

AREA Route 14

BORING NO D-1   SAMPLE NO 16

EL -46.1' to -47.3'   DATE 23 Jan 1968

RESIDUAL DIRECT SHEAR TEST REPORT Sheet 1 of 2

ENG FORM 1 JUN 65 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)   GPO 1966 OF 210-47   PLATE IX-3

Residual Direct Shear Test Report — Pre-split Specimens

0.001 in/min.
2" x 2" x 1/2" Specimens

Displacement per cycle

Normal Stress

Shear Stress (T/SF)

12.0 T/SF
8.0 T/SF
4.0 T/SF

Vertical Deformation In X10⁻⁴

8.0 T/SF
4.0 T/SF
12.0 T/SF

Total Horizontal Displacement (in.)

Shear Strength (T/SF)

Maximum 15.5°
At 10" Displacement 15.5°
11.5°
Ultimate

Normal Stress (T/SF)

REQN. NO. 08-123-ENG-54-68C
W. O. NO. 4880

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY,
CORPS OF ENGINEERS, P. O. BOX 51, MARIETTA, GEORGIA 30060

Residual Direct Shear Test Report
Pre-split Specimens

IOCS - Route 14
Boring D-1
Sample 16
El. -46.1' to -47.3'

Lab. No. 224/04

FG

Sheet 2 of 2

B10

a. Immediately after extrusion from Shelby tube

b. Single-plane direct shear test after failure at
4-tsf normal load

Figure B1. La Pita Hill study, agglomerate from
boring ERE-25A, sample No. 6, depth 125.0 to
127.0 ft (sheet 1 of 2)

B11

c. Single-plane direct shear test after failure at
8-tsf normal load
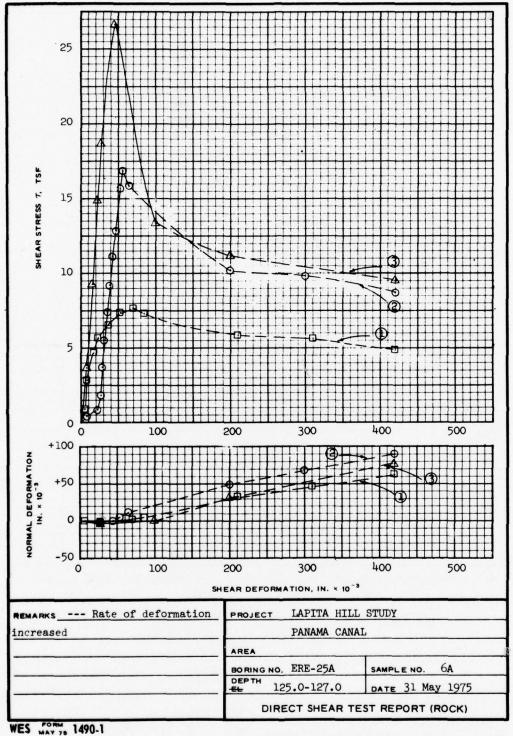
d. Single-plane direct shear test after failure at
12-tsf normal load

Figure B1 (sheet 2 of 2)

SHEAR STRESS τ, TSF

SHEAR STRENGTH s, TSF

NORMAL DEFORMATION, IN. × 10⁻³

SEE SHEET NO.

SEE SHEET NO.

SHEAR DEFORMATION, IN. × 10⁻³

NORMAL STRESS σ, TSF

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
$\phi =$	65.2°	39.8°
TAN $\phi =$	2.164	0.833
c =	0.0	2.1 TSF

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_m	131.4	131.7	133.7			
WATER CONTENT	w	22.4 %	18.3 %	17.5 %	%	%	%
NORMAL STRESS, TSF	σ	4.0	8.0	12.0			
MAXIMUM SHEAR STRESS, TSF	τ_f	7.65	16.87	26.67			
TIME TO FAILURE, MINUTES	t_f	10	11	6			
ULTIMATE SHEAR STRESS, TSF	τ_r	4.92	8.71	9.47			
INITIAL DIAMETER, IN.	Do	4.977	4.985	4.958			
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL Agglomerate, OH-5, very hard overburden, to RH-3, medium
hard rock (PCC)

REMARKS   Intact specimens

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. ERE-25A   SAMPLE NO. 6A

DEPTH EL   125.0-127.0   DATE 31 May 1975

TES RCH   DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490   EDITION OF JUN 65 IS OBSOLETE

SHEET NO.

B13

SHEAR STRESS τ, TSF

25

20

15

10

5

0

0   100   200   300   400   500

③
△
◎
②

①

NORMAL DEFORMATION IN. × 10⁻³

+100

+50

0

-50

0   100   200   300   400   500

②
③
①

SHEAR DEFORMATION, IN. × 10⁻³

REMARKS --- Rate of deformation increased	PROJECT LAPITA HILL STUDY
	PANAMA CANAL
	AREA
	BORING NO. ERE-25A	SAMPLE NO. 6A
	DEPTH EL 125.0-127.0	DATE 31 May 1975
	DIRECT SHEAR TEST REPORT (ROCK)

SHEET NO.

SHEAR STRENGTH s, TSF

NORMAL STRESS σ, TSF

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

| BORING NO. | ERE-25A | SAMPLE NO. | 6A |
| DEPTH EL | 125.0-127.0 | DATE | 31 May 1975 |

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM MAY 75 1490-2

SHEET NO.

a. Immediately after extrusion from Shelby tube
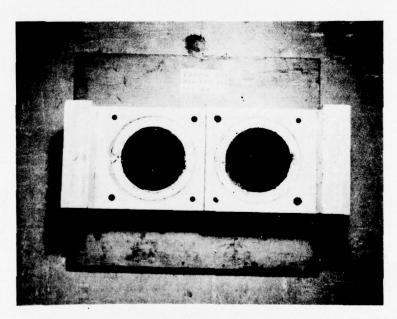
b. Single-plane direct shear test after failure at 4-tsf normal load

Figure B2. La Pita Hill study, tuff from boring ERE-25A, sample No. 8, depth 165.8 to 168.3 ft (sheet 1 of 2)
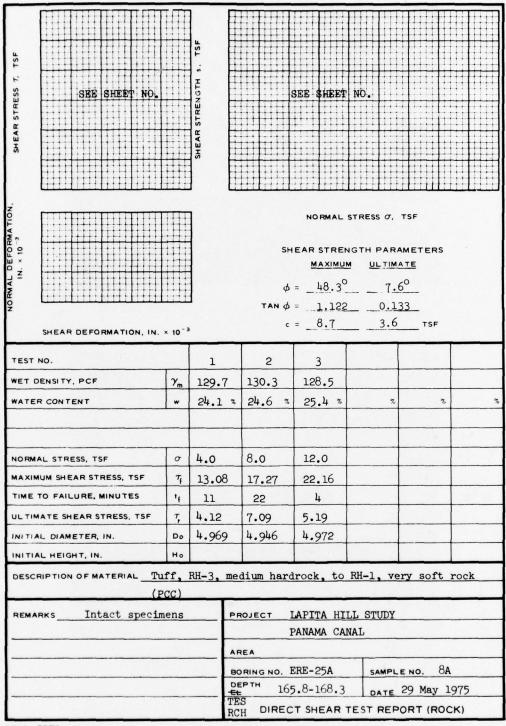
B16

c. Single-plane direct shear test after failure at 8-tsf normal load
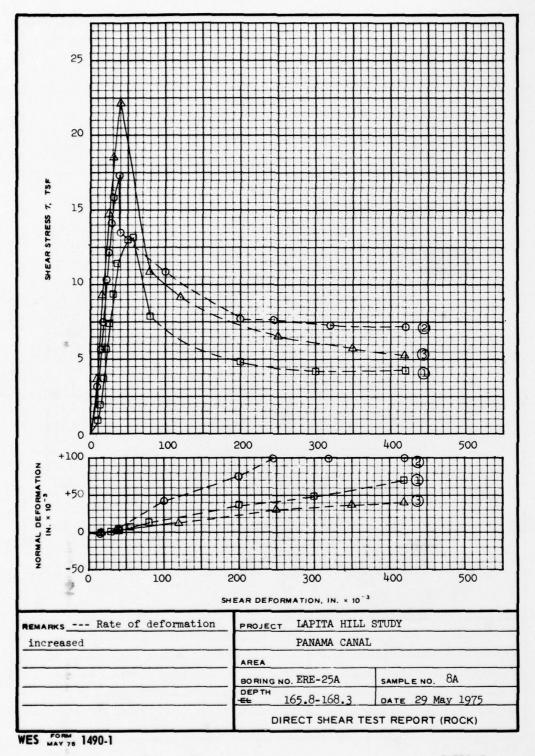
d. Single-plane direct shear test after failure at 12-tsf normal load

Figure B2 (sheet 2 of 2)

B17

SHEAR STRESS τ, TSF

SHEAR STRENGTH s, TSF

NORMAL DEFORMATION, IN. × 10⁻³

SEE SHEET NO.

SEE SHEET NO.

NORMAL STRESS σ, TSF

SHEAR DEFORMATION, IN. × 10⁻³

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	48.3°	7.6°
TAN ϕ =	1.122	0.133
c =	8.7	3.6 TSF

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_m	129.7	130.3	128.5			
WATER CONTENT	w	24.1 %	24.6 %	25.4 %	%	%	%
NORMAL STRESS, TSF	σ	4.0	8.0	12.0			
MAXIMUM SHEAR STRESS, TSF	τ_f	13.08	17.27	22.16			
TIME TO FAILURE, MINUTES	t_f	11	22	4			
ULTIMATE SHEAR STRESS, TSF	τ_r	4.12	7.09	5.19			
INITIAL DIAMETER, IN.	Do	4.969	4.946	4.972			
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL   Tuff, RH-3, medium hardrock, to RH-1, very soft rock
(PCC)

REMARKS Intact specimens	PROJECT LAPITA HILL STUDY
	PANAMA CANAL
	AREA
	BORING NO. ERE-25A SAMPLE NO. 8A
	DEPTH EL 165.8-168.3 DATE 29 May 1975
	TES RCH DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490   EDITION OF JUN 65 IS OBSOLETE

SHEET NO.

SHEAR STRESS τ, TSF

25

20

15

10

5

0

0   100   200   300   400   500

②
③
①

NORMAL DEFORMATION IN. × 10⁻³

+100

+50

0

-50

0   100   200   300   400   500

②
①
③

SHEAR DEFORMATION, IN. × 10⁻³

REMARKS --- Rate of deformation increased	PROJECT LAPITA HILL STUDY	
	PANAMA CANAL	
	AREA	
	BORING NO. ERE-25A	SAMPLE NO. 8A
	DEPTH EL 165.8-168.3	DATE 29 May 1975
	DIRECT SHEAR TEST REPORT (ROCK)	

WES FORM MAY 75 1490-1

SHEET NO.

B19

SHEAR STRENGTH s, TSF

NORMAL STRESS σ, TSF

a. Immediately after extrusion from Shelby tube

b. Single-plane direct shear test after failure at
4-tsf normal load

Figure B3. La Pita Hill study, tuff from boring
ERE-25A, sample No. 11, depth 212.0 to 214.1 ft
(sheet 1 of 2)

c. Single-plane direct shear test after failure
at 8-tsf normal load
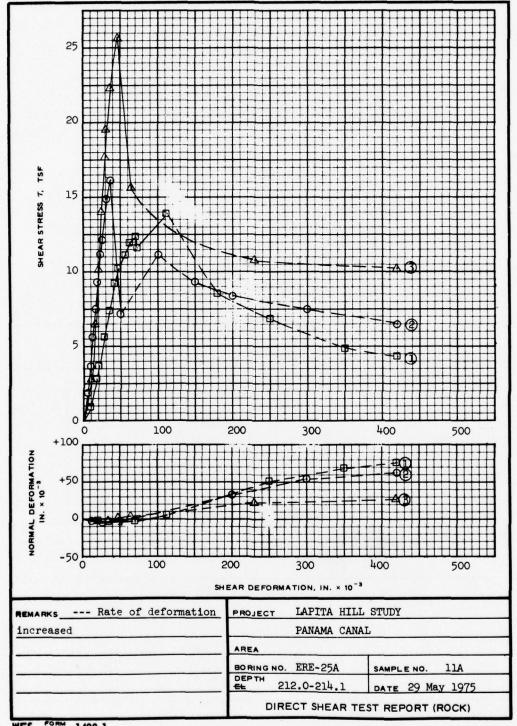
d. Single-plane direct shear test after failure
at 12-tsf normal load

Figure B3 (sheet 2 of 2)

B22

SHEAR STRESS τ, TSF

SHEAR STRENGTH s, TSF

NORMAL DEFORMATION, IN. × 10⁻³

SEE SHEET NO.

SEE SHEET NO.

NORMAL STRESS σ, TSF

SHEAR DEFORMATION, IN. × 10⁻³

SHEAR STRENGTH PARAMETERS
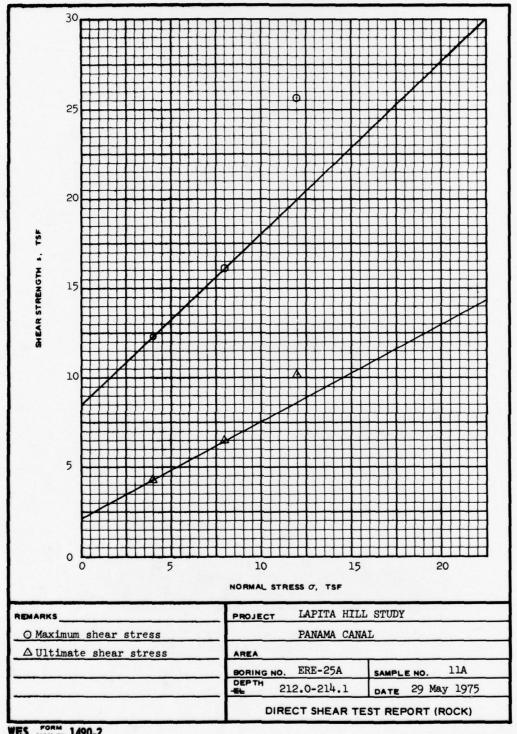
	MAXIMUM	ULTIMATE	
ϕ =	44.3°	28.6°	
TAN ϕ =	0.976	0.545	
c =	8.5	2.1	TSF

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_m	139.2	139.6	138.9			
WATER CONTENT	w	15.7 %	16.5 %	16.3 %	%	%	%
NORMAL STRESS, TSF	σ	4.0	8.0	12.0			
MAXIMUM SHEAR STRESS, TSF	τ_f	12.32	16.06	25.67			
TIME TO FAILURE, MINUTES	t_f	8	9	15			
ULTIMATE SHEAR STRESS, TSF	τ_r	4.29	6.50	10.23			
INITIAL DIAMETER, IN.	Do	4.979	4.955	4.965			
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL Tuff, RH-1, soft rock, to RH-2, medium soft rock (PCC)

REMARKS Intact specimens	PROJECT LAPITA HILL STUDY
	PANAMA CANAL
	AREA
	BORING NO. ERE-25A SAMPLE NO. 11A
	DEPTH EL 212.0-214.1 DATE 29 May 1975
	TES RCH DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490   EDITION OF JUN 65 IS OBSOLETE

SHEET NO.

B23

REMARKS	--- Rate of deformation increased	PROJECT	LAPITA HILL STUDY

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. ERE-25A   SAMPLE NO.   11A

DEPTH
EL   212.0-214.1   DATE 29 May 1975

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM 1490-1
MAY 75

SHEET NO.

SHEAR STRENGTH s, TSF

NORMAL STRESS σ, TSF

REMARKS

○ Maximum shear stress

△ Ultimate shear stress

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. ERE-25A   SAMPLE NO.   11A

DEPTH
EL   212.0-214.1   DATE 29 May 1975

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM
MAY 75 1490-2

B25

SHEET NO.

a. Single-plane direct shear test after failure at
4-tsf normal load
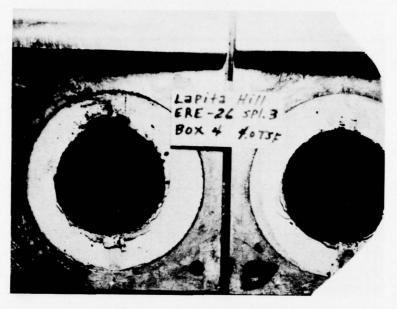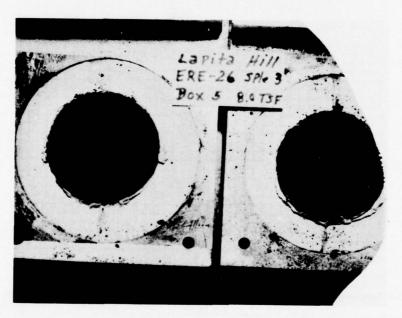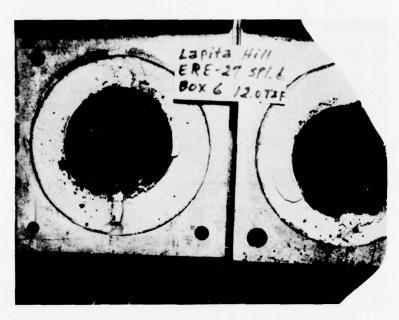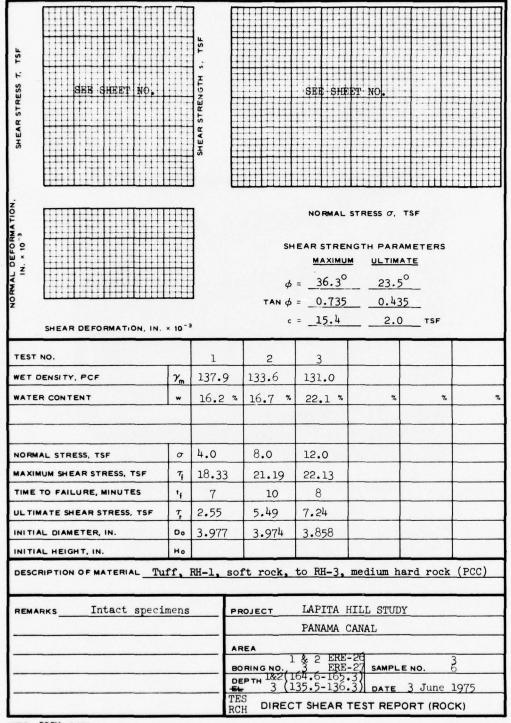
b. Single-plane direct shear test after failure at
8-tsf normal load

Figure B4. La Pita Hill study, tuff from boring
ERE-26, sample No. 3, depth 164.6 to 165.3 ft
(sheet 1 of 2)
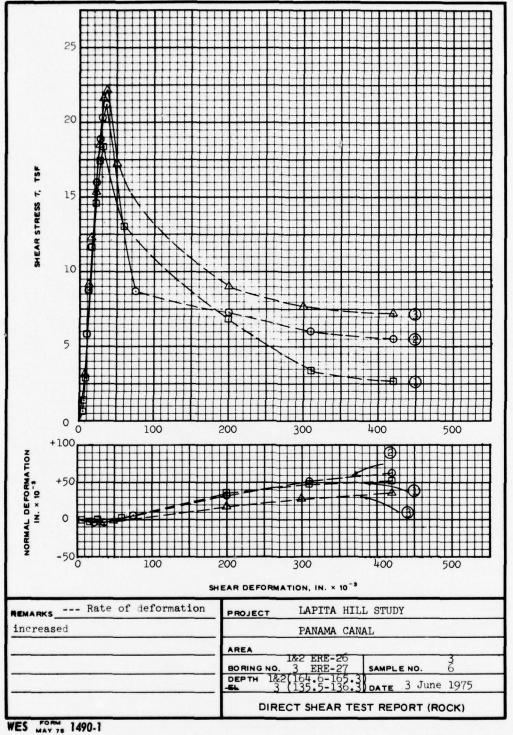
c. Single-plane direct shear test after failure
at 12-tsf normal load

Figure B4 (sheet 2 of 2--Substituted sample tuff
from boring ERE-27, sample No. 6, depth 135.5 to
136.3 because of insufficient material in Boring
ERE-26, sample No. 3)

SHEAR STRESS T, TSF

SHEAR STRENGTH s, TSF

SEE SHEET NO.

SEE SHEET NO.

NORMAL DEFORMATION, IN. × 10⁻³

NORMAL STRESS σ, TSF

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE	
ϕ =	36.3°	23.5°	
TAN ϕ =	0.735	0.435	
c =	15.4	2.0	TSF

SHEAR DEFORMATION, IN. × 10⁻³

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_m	137.9	133.6	131.0			
WATER CONTENT	w	16.2 %	16.7 %	22.1 %	%	%	%
NORMAL STRESS, TSF	σ	4.0	8.0	12.0			
MAXIMUM SHEAR STRESS, TSF	τ_f	18.33	21.19	22.13			
TIME TO FAILURE, MINUTES	t_f	7	10	8			
ULTIMATE SHEAR STRESS, TSF	τ_r	2.55	5.49	7.24			
INITIAL DIAMETER, IN.	Do	3.977	3.974	3.858			
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL Tuff, RH-1, soft rock, to RH-3, medium hard rock (PCC)

REMARKS   Intact specimens

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. 1 & 2 ERE-26 SAMPLE NO. 3
            3   ERE-27   6

DEPTH 1&2(164.6-165.3)
EL   3 (135.5-136.3)   DATE 3 June 1975

TES
RCH   DIRECT SHEAR TEST REPORT (ROCK)

WES FORM 1490
APR 75   EDITION OF JUN 65 IS OBSOLETE

SHEET NO.

SHEAR STRESS τ, TSF

25

20

15

10

5

0

0   100   200   300   400   500

NORMAL DEFORMATION IN. × 10⁻³

+100

+50

0

-50

0   100   200   300   400   500

SHEAR DEFORMATION, IN. × 10⁻³

REMARKS --- Rate of deformation increased	PROJECT	LAPITA HILL STUDY	
		PANAMA CANAL	
	AREA		
	BORING NO. 1&2 ERE-26 3 ERE-27	SAMPLE NO.	3 6
	DEPTH 1&2 (164.6-165.3) EL 3 (135.5-136.3)	DATE	3 June 1975
	DIRECT SHEAR TEST REPORT (ROCK)		

WES FORM MAY 75 1490-1

SHEET NO.

B29

SHEAR STRENGTH s, TSF

NORMAL STRESS σ, TSF

REMARKS	PROJECT	LAPITA HILL STUDY	
○ Maximum shear stress		PANAMA CANAL	
△ Ultimate shear stress	AREA		
	BORING NO. 1&2 ERE-26 3 ERE-27	SAMPLE NO.	3 6
	DEPTH 1&2 (164.6-165.3) EL 3 (135.5-136.3)	DATE	3 June 1975
	DIRECT SHEAR TEST REPORT (ROCK)		

WES FORM MAY 75 1490-2

B30   SHEET NO.

a. Single-plane direct shear test after failure at
4-tsf normal load

b. Single-plane direct shear test after failure at
8-tsf normal load

Figure B5. La Pita Hill study, tuff from boring
ERE-27, sample No. 7, depth 141.4 to 142.5 ft
(sheet 1 of 2)
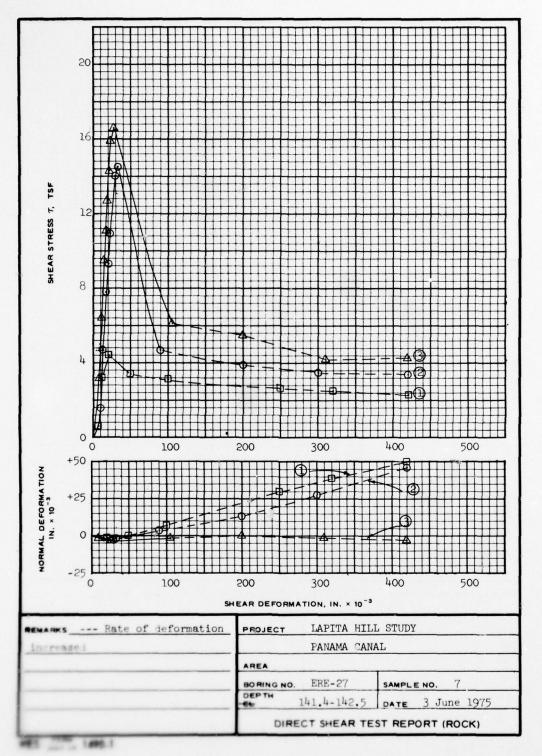
c. Single-plane direct shear test after failure at
12-tsf normal load
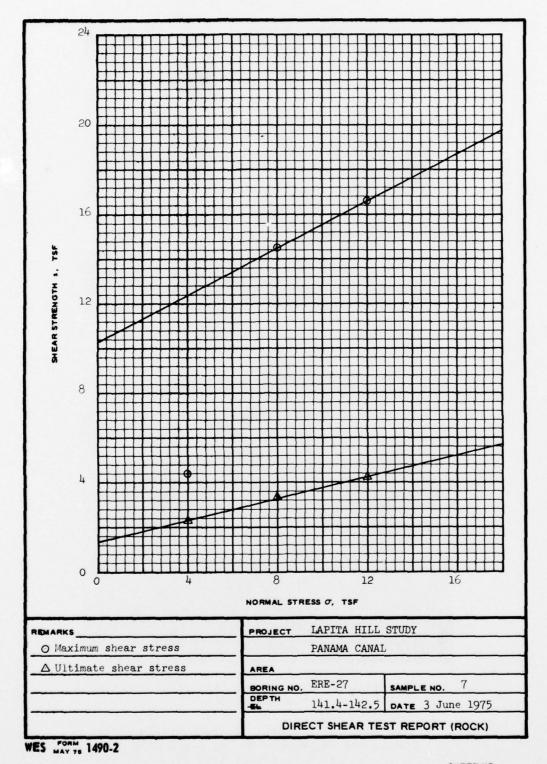
Figure B5   (sheet 2 of 2)

SHEAR STRESS τ, TSF

SEE SHEET NO.

SHEAR STRENGTH s, TSF

SEE SHEET NO.

NORMAL DEFORMATION, IN. × 10^{-3}

NORMAL STRESS σ, TSF

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	28.0°	13.8°
TAN ϕ =	0.532	0.246
c =	10.3	1.4 TSF

SHEAR DEFORMATION, IN. × 10^{-3}

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_m	122.8	123.6	123.3			
WATER CONTENT	w	29.3 %	28.6 %	27.2 %	%	%	%
NORMAL STRESS, TSF	σ	4.0	8.0	12.0			
MAXIMUM SHEAR STRESS, TSF	τ_f	4.40	14.48	16.60			
TIME TO FAILURE, MINUTES	t_f	5	4	6			
ULTIMATE SHEAR STRESS, TSF	τ_r	2.30	3.42	4.23			
INITIAL DIAMETER, IN.	Do	3.792	3.838	3.797			
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL Tuff, RH-2, medium soft rock, to RH-3, medium hard rock (PCC)

REMARKS   Intact specimens

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. ERE-27   SAMPLE NO.   7

DEPTH EL   141.4-142.5   DATE 3 June 1975

TES RCH   DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490   EDITION OF JUN 65 IS OBSOLETE

SHEET NO.

B33

SHEAR STRESS τ, TSF

NORMAL DEFORMATION IN. × 10⁻³

SHEAR DEFORMATION, IN. × 10⁻³

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO.   ERE-27   SAMPLE NO.   7

DEPTH EL   141.4-142.5   DATE   3 June 1975

DIRECT SHEAR TEST REPORT (ROCK)

SHEET NO.

SHEAR STRENGTH s, TSF

NORMAL STRESS σ, TSF

REMARKS	PROJECT	LAPITA HILL STUDY	
○ Maximum shear stress		PANAMA CANAL	
△ Ultimate shear stress	AREA		
	BORING NO. ERE-27	SAMPLE NO. 7	
	DEPTH EL 141.4-142.5	DATE 3 June 1975	
	DIRECT SHEAR TEST REPORT (ROCK)		

WES FORM MAY 75 1490-2

SHEET NO.

B35

a. Single-plane direct shear test after failure at
4-tsf normal load
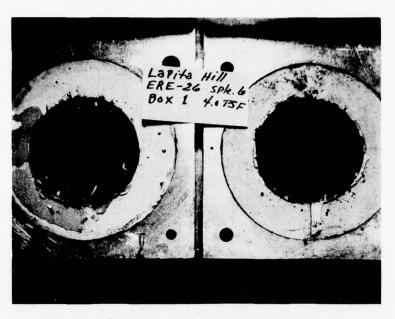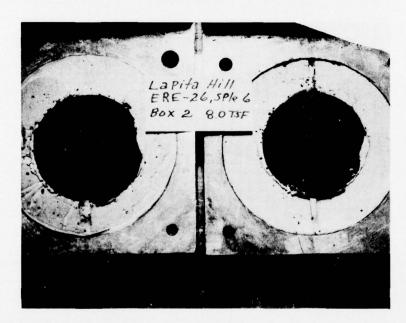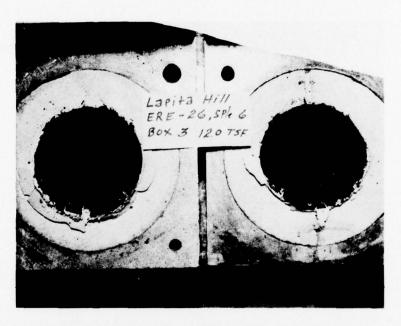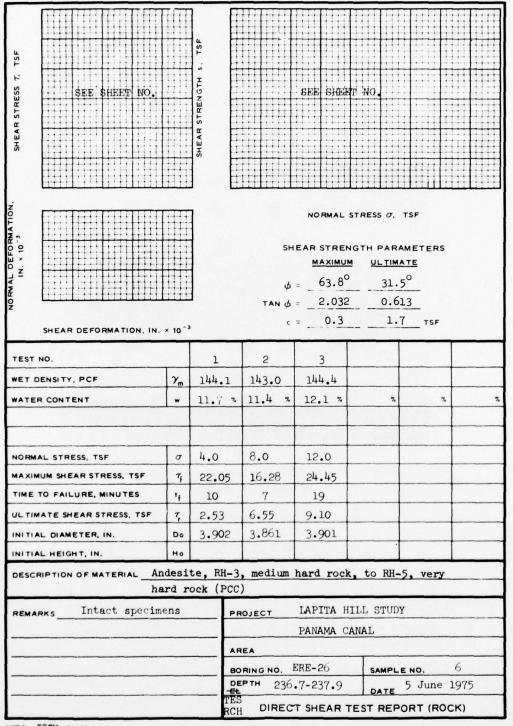
b. Single-plane direct shear test after failure at
8-tsf normal load

Figure B6. La Pita Hill study, andesite from
boring ERE-26, sample No. 6, depth 236.7 to
237.9 ft (sheet 1 of 2)
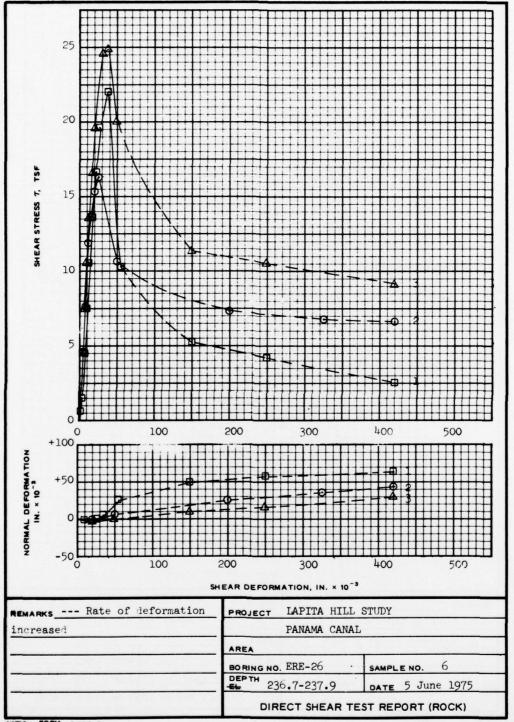
c. Single-plane direct shear test after failure at
12-tsf normal load

Figure B6 (sheet 2 of 2)

B37

SHEAR STRESS τ, TSF

SHEAR STRENGTH s, TSF

NORMAL DEFORMATION, IN. × 10⁻³

SEE SHEET NO.

SEE SHEET NO.

NORMAL STRESS σ, TSF

SHEAR DEFORMATION, IN. × 10⁻³

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	63.8°	31.5°
TAN ϕ =	2.032	0.613
c =	0.3	1.7 TSF

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_m	144.1	143.0	144.4			
WATER CONTENT	w	11.7 %	11.4 %	12.1 %	%	%	%
NORMAL STRESS, TSF	σ	4.0	8.0	12.0			
MAXIMUM SHEAR STRESS, TSF	τ_f	22.05	16.28	24.45			
TIME TO FAILURE, MINUTES	t_f	10	7	19			
ULTIMATE SHEAR STRESS, TSF	τ_r	2.53	6.55	9.10			
INITIAL DIAMETER, IN.	Do	3.902	3.861	3.901			
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL Andesite, RH-3, medium hard rock, to RH-5, very hard rock (PCC)

REMARKS Intact specimens

PROJECT LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. ERE-26

SAMPLE NO. 6

DEPTH 236.7-237.9

DATE 5 June 1975

TES
RCH

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490   EDITION OF JUN 65 IS OBSOLETE

SHEET NO.

SHEAR STRESS τ, TSF

NORMAL DEFORMATION IN. × 10⁻³

SHEAR DEFORMATION, IN. × 10⁻³

REMARKS --- Rate of deformation increased

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. ERE-26   SAMPLE NO.   6

DEPTH 236.7-237.9   DATE 5 June 1975

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM MAY 75 1490-1

B39   SHEET NO.

SHEAR STRENGTH s, TSF

NORMAL STRESS σ, TSF

REMARKS

○ Maximum shear stress

△ Ultimate shear stress

PROJECT	LAPITA HILL STUDY	
	PANAMA CANAL	
AREA		
BORING NO. ERE-26	SAMPLE NO. 6	
DEPTH EL. 236.7-237.9	DATE 5 June 1975	
DIRECT SHEAR TEST REPORT (ROCK)		

WES FORM MAY 76 1490-2

B40

SHEET NO.

Figure B7. La Pita Hill study, agglomerate tuff
(fault zone) from boring ERE-26, sample No. 5,
depth 209.8 to 210.3. Multistage direct shear
conducted at 4, 8, and 12 tsf
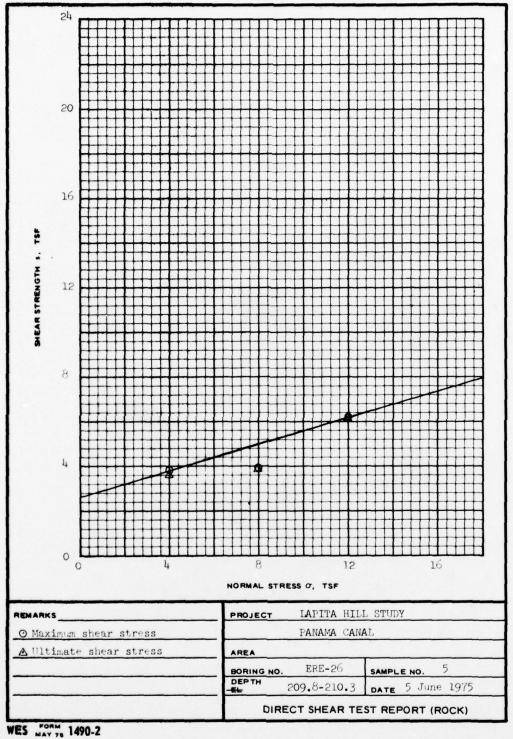
SHEAR STRESS τ, TSF

SHEAR STRENGTH s, TSF

NORMAL DEFORMATION, IN. × 10⁻³

SHEAR DEFORMATION, IN. × 10⁻³

NORMAL STRESS σ, TSF

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE	
$\phi =$	16.5°	16.5°	
TAN $\phi =$	0.296	0.296	
c =	2.6	2.6	TSF

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_m	121.2					
WATER CONTENT	w	21.6%	%	%	%	%	%
NORMAL STRESS, TSF	σ	4.0	8.0	12.0			
MAXIMUM SHEAR STRESS, TSF	τ_f	3.84	3.90	6.21			
TIME TO FAILURE, MINUTES	t_f	29	49	21			
ULTIMATE SHEAR STRESS, TSF	τ_f	3.64	3.90	6.21			
INITIAL DIAMETER, IN.	Do	3.937					
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL Agglomeratic tuff (fault zone), RH-2, medium soft rock,
to RH-3, medium hard rock (PCC)

REMARKS   Step load

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO. ERE-26   SAMPLE NO. 5

DEPTH 209.8-210.3   DATE 5 June 1975

TES

RCH DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490   EDITION OF JUN 65 IS OBSOLETE

SHEET NO.

SHEAR STRENGTH s, TSF

NORMAL STRESS σ, TSF

REMARKS

⊙ Maximum shear stress

△ Ultimate shear stress

PROJECT   LAPITA HILL STUDY

PANAMA CANAL

AREA

BORING NO.   ERE-26   SAMPLE NO.   5

DEPTH EL   209.8-210.3   DATE 5 June 1975

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM MAY 75 1490-2

SHEET NO.

B44
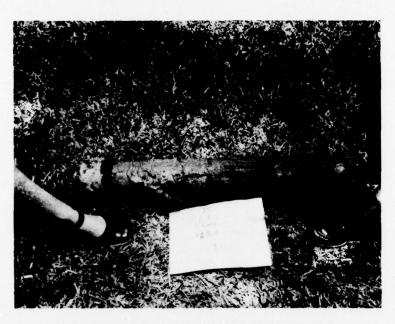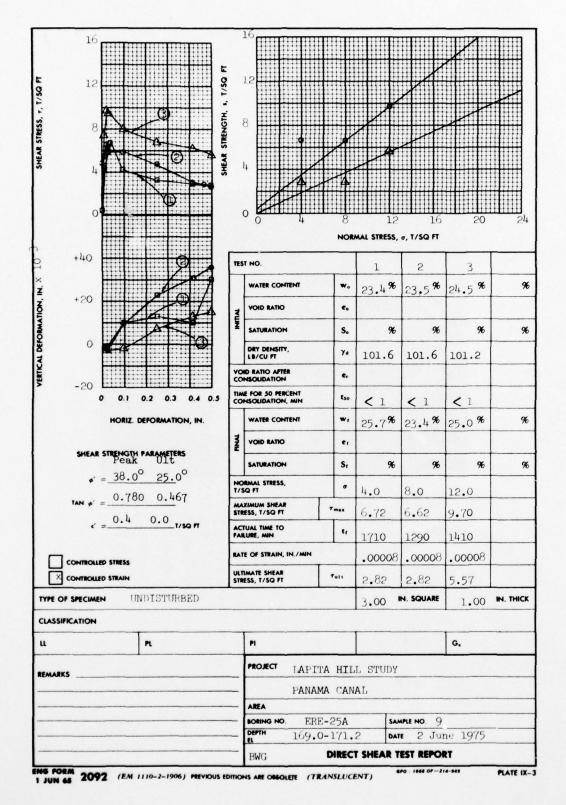
Figure B8. La Pita Hill study, tuff from boring
ERE-25A, sample No. 9, depth 169.0 to 172.1 ft.
Pretest photography immediately after extrusion
from Shelby tube

DIRECT SHEAR TEST REPORT

SHEAR STRESS, τ, T/SQ FT

SHEAR STRENGTH, s, T/SQ FT

VERTICAL DEFORMATION, IN. $\times 10^{-3}$

HORIZ. DEFORMATION, IN.

NORMAL STRESS, σ, T/SQ FT

SHEAR STRENGTH PARAMETERS

	Peak	Ult
$\phi' =$	$38.0°$	$25.0°$
TAN $\phi' =$	0.780	0.467
$c' =$	0.4	0.0 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	%
INITIAL	WATER CONTENT	w_o	23.4 %	23.5 %	24.5 %	%
	VOID RATIO	e_o				
	SATURATION	S_o	%	%	%	%
	DRY DENSITY, LB/CU FT	γ_d	101.6	101.6	101.2	
	VOID RATIO AFTER CONSOLIDATION	e_c				
	TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	< 1	< 1	< 1	
FINAL	WATER CONTENT	w_f	25.7 %	23.4 %	25.0 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
	NORMAL STRESS, T/SQ FT	σ	4.0	8.0	12.0	
	MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	6.72	6.62	9.70	
	ACTUAL TIME TO FAILURE, MIN	t_f	1710	1290	1410	
	RATE OF STRAIN, IN./MIN		.00008	.00008	.00008	
	ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}	2.82	2.82	5.57	

TYPE OF SPECIMEN	UNDISTURBED	3.00 IN. SQUARE	1.00 IN. THICK

CLASSIFICATION

LL	PL	PI		G_s

REMARKS

PROJECT	LAPITA HILL STUDY
	PANAMA CANAL
AREA	
BORING NO. ERE-25A	SAMPLE NO. 9
DEPTH EL 169.0-171.2	DATE 2 June 1975
BWG	**DIRECT SHEAR TEST REPORT**

SHEAR STRESS, τ, T/SQ FT

VERTICAL DEFORMATION, IN.

0   0.1   0.2   0.3   0.4   0.5

HORIZ. DEFORMATION, IN.

SHEAR STRENGTH PARAMETERS

$\phi' = $ _8.29°_

$TAN\ \phi' = $ _0.146_

$c' = $ _0.0_ T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

SHEAR STRENGTH, τ, T/SQ FT

8
6
4
2
0

0   2   4   6   8   10   12

NORMAL STRESS, σ, T/SQ FT

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	39.1 %	38.9 %	42.1 %	%
	VOID RATIO	e_o				
	SATURATION	S_o	%	%	%	%
	DRY DENSITY, LB/CU FT	γ_d	78.3	79.5	77.5	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	%	%	%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	4.0	8.0	12.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}				
ACTUAL TIME TO FAILURE, MIN		t_f				
RATE OF STRAIN, IN./MIN						
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN	3.01 IN. SQUARE	0.553 IN. THICK

CLASSIFICATION				
LL	PL	PI		G_s

REMARKS _____
_____
_____
_____
_____
_____

PROJECT   LA PITA HILL STUDY
          PANAMA CANAL

AREA

BORING NO.   ERE-27   SAMPLE NO.   4
DEPTH EL   74.5-75.5   DATE 18 June 1975
BWG   **DIRECT SHEAR TEST REPORT**

LA PITA HILL STUDY
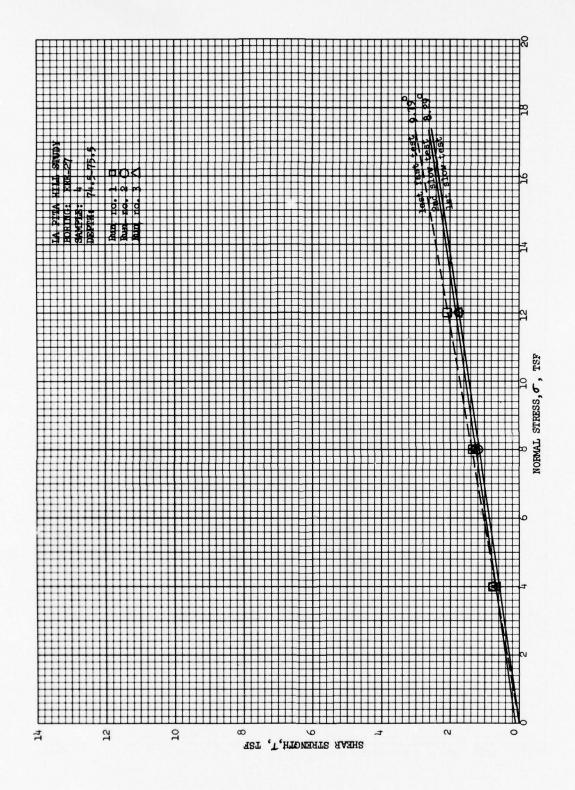
PANAMA CANAL

BORING ERE-27
SAMPLE 4
DEPTH 74.5-75.5
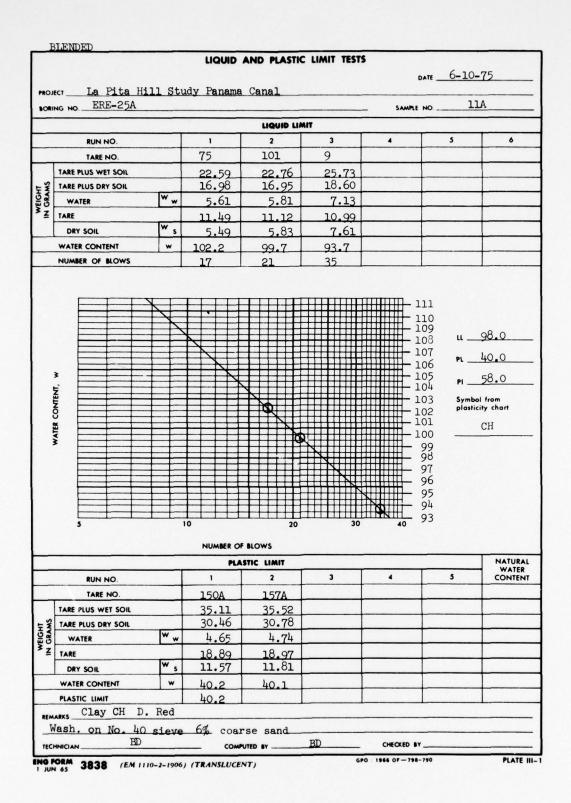
Run No.		σ TSF	Rate of strain in/hr	Per Run in	Accumulated in	τ TSF	Ratio τ/σ
1.	(20th fast)	4	2.00 in/hr	0.25	5.00	0.77	0.19
		8	2.00 in/hr	0.25	5.00	1.34	0.17
		12	2.00 in/hr	0.25	5.00	2.08	0.17
2.	(1st slow)	4	0.018 in/hr	0.3866	5.3866	0.77	0.19
		8	0.018 in/hr	0.3866	5.3866	1.18	0.15
		12	0.018 in/hr	0.3866	5.3866	1.76	0.15
3.	(2nd slow)	4	0.0185 in/hr	0.4070	5.7936	0.70	0.18
		8	0.0185 in/hr	0.4070	5.7936	1.28	0.16
		12	0.0185 in/hr	0.4070	5.7936	1.76	0.20

B48

LA PITA HILL STUDY
BORING: EXR-27
SAMPLE: 4
DEPTH: 74.5-75.5

Run no. 1 □
Run no. 2 ○
Run no. 3 △

1st fast test 9.19°
2nd slow test 8.29°
1st slow test

SHEAR STRENGTH, τ, TSF

NORMAL STRESS, σ, TSF

B49

LIQUID AND PLASTIC LIMIT TESTS

DATE **6-11-75**

PROJECT **La Pita Hill Study, Panama Canal**

BORING NO. **ERE-25A** SAMPLE NO. **6-A**

LIQUID LIMIT

	RUN NO.		1	2	3	4	5	6
	TARE NO.		124A	125A	174A	175		
WEIGHT IN GRAMS	TARE PLUS WET SOIL		27.64	24.97	30.44	33.43		
	TARE PLUS DRY SOIL		19.18	17.88	24.57	26.18		
	WATER	W_w	8.46	7.09	5.87	7.25		
	TARE		11.13	11.02	18.79	18.81		
	DRY SOIL	W_s	8.05	6.86	5.78	7.29		
	WATER CONTENT	w	105.1	103.4	101.6	99.5		
	NUMBER OF BLOWS		16	22	28	34		

LL **102.0**

PL **22.0**

PI **80.0**

Symbol from plasticity chart

CH

NUMBER OF BLOWS

PLASTIC LIMIT

	RUN NO.		1	2	3	4	5	NATURAL WATER CONTENT
	TARE NO.		147A	154A				
WEIGHT IN GRAMS	TARE PLUS WET SOIL		33.57	32.79				
	TARE PLUS DRY SOIL		30.90	30.27				
	WATER	W_w	2.67	2.52				
	TARE		18.90	18.88				
	DRY SOIL	W_s	12.00	11.39				
	WATER CONTENT	w	22.3	22.1				
	PLASTIC LIMIT		22.2					

REMARKS **Clay CH D. Gray**

Wash. on No. 40 sieve 5% coarse sand

TECHNICIAN **BD** COMPUTED BY **BD** CHECKED BY _____

ENG FORM **3838** *(EM 1110-2-1906) (TRANSLUCENT)*
1 JUN 65

GPO : 1966 OF—79R-790

PLATE III-1

LIQUID AND PLASTIC LIMIT TESTS

DATE __6-11-75__

PROJECT __La Pita Hill Study, Panama Canal__

BORING NO. __ERE-25A__   SAMPLE NO. __8A__

LIQUID LIMIT

	RUN NO.		1	2	3	4	5	6
	TARE NO.		5A	53A	73A	79A		
WEIGHT IN GRAMS	TARE PLUS WET SOIL		24.40	26.85	25.51	26.61		
	TARE PLUS DRY SOIL		17.70	19.04	18.44	19.04		
	WATER	W_w	6.70	7.81	7.07	7.58		
	TARE		11.06	11.09	11.16	11.00		
	DRY SOIL	W_s	6.64	7.95	7.28	8.04		
	WATER CONTENT	w	100.9	98.2	97.1	94.3		
	NUMBER OF BLOWS		15	21	27	35		

WATER CONTENT, W

NUMBER OF BLOWS

LL __97.0__

PL __39.0__

PI __58.0__

Symbol from plasticity chart

__CH__

PLASTIC LIMIT

	RUN NO.		1	2	3	4	5	NATURAL WATER CONTENT
	TARE NO.		110	131				
WEIGHT IN GRAMS	TARE PLUS WET SOIL		29.19	26.59				
	TARE PLUS DRY SOIL		24.19	22.27				
	WATER	W_w	5.00	4.32				
	TARE		11.40	11.24				
	DRY SOIL	W_s	12.79	11.03				
	WATER CONTENT	w	39.1	39.2				
	PLASTIC LIMIT		39.2					

REMARKS __Clay (CH) D. Cherry Red__

__Wash on No. 40 sieve 5% coarse sand__

TECHNICIAN __BD__   COMPUTED BY __BD__   CHECKED BY _____

ENG FORM 3838   (EM 1110-2-1906) (TRANSLUCENT)   GPO : 1966 OF—798-790   PLATE III-1
1 JUN 65

LIQUID AND PLASTIC LIMIT TESTS

DATE __6-10-75__

PROJECT __La Pita Hill Study Panama Canal__

BORING NO. __ERE-25A__   SAMPLE NO. __11A__

LIQUID LIMIT

	RUN NO.		1	2	3	4	5	6
	TARE NO.		75	101	9			
WEIGHT IN GRAMS	TARE PLUS WET SOIL		22.59	22.76	25.73			
	TARE PLUS DRY SOIL		16.98	16.95	18.60			
	WATER	W_w	5.61	5.81	7.13			
	TARE		11.49	11.12	10.99			
	DRY SOIL	W_s	5.49	5.83	7.61			
	WATER CONTENT	w	102.2	99.7	93.7			
	NUMBER OF BLOWS		17	21	35			

WATER CONTENT, w

NUMBER OF BLOWS

LL __98.0__

PL __40.0__

PI __58.0__

Symbol from plasticity chart

CH

PLASTIC LIMIT

	RUN NO.		1	2	3	4	5	NATURAL WATER CONTENT
	TARE NO.		150A	157A				
WEIGHT IN GRAMS	TARE PLUS WET SOIL		35.11	35.52				
	TARE PLUS DRY SOIL		30.46	30.78				
	WATER	W_w	4.65	4.74				
	TARE		18.89	18.97				
	DRY SOIL	W_s	11.57	11.81				
	WATER CONTENT	w	40.2	40.1				
	PLASTIC LIMIT		40.2					

REMARKS __Clay CH D. Red__

__Wash. on No. 40 sieve 6% coarse sand__

TECHNICIAN __BD__   COMPUTED BY __BD__   CHECKED BY _____

ENG FORM 3838 (EM 1110-2-1906) (TRANSLUCENT)   GPO : 1966 OF—798-790   PLATE III-1
1 JUN 65

BLENDED

LIQUID AND PLASTIC LIMIT TESTS

PROJECT La Pita Hill Study, Panama Canal

BORING NO. ERE-25A   SAMPLE NO. 11B

LIQUID LIMIT

	RUN NO.		1	2	3	4	5	6
	TARE NO.		51A	29A	30A	53A		
WEIGHT IN GRAMS	TARE PLUS WET SOIL		24.87	28.26	27.33	28.10		
	TARE PLUS DRY SOIL		18.48	20.50	20.13	20.61		
	WATER	W_w	6.39	7.76	7.20	7.49		
	TARE		10.95	11.17	11.32	11.09		
	DRY SOIL	W_s	7.53	9.33	8.81	9.52		
	WATER CONTENT	w	84.9	83.2	81.7	78.7		
	NUMBER OF BLOWS		15	22	28	35		

WATER CONTENT, W

NUMBER OF BLOWS

LL 82.0

PL 30.0

PI 52.0

Symbol from plasticity chart

CH

PLASTIC LIMIT

	RUN NO.		1	2	3	4	5	NATURAL WATER CONTENT
	TARE NO.		130	131				
WEIGHT IN GRAMS	TARE PLUS WET SOIL		23.25	22.02				
	TARE PLUS DRY SOIL		20.51	19.55				
	WATER	W_w	2.74	2.47				
	TARE		11.31	11.24				
	DRY SOIL	W_s	9.20	8.31				
	WATER CONTENT	w	29.9	29.7				
	PLASTIC LIMIT		29.8					

REMARKS Clay (CH)   D. Red
Wash on No. 40 sieve

TECHNICIAN BD   COMPUTED BY BD   CHECKED BY _____

BLENDED

LIQUID AND PLASTIC LIMIT TESTS

DATE __6-18-75__

PROJECT ___La Pita Hill Study, Panama Canal___

BORING NO. __ERE-26__   SAMPLE NO. ___3___

LIQUID LIMIT

	RUN NO.		1	2	3	4	5	6
	TARE NO.		66A	73A	78A	89A		
WEIGHT IN GRAMS	TARE PLUS WET SOIL		25.12	26.02	22.58	26.10		
	TARE PLUS DRY SOIL		18.96	19.49	17.62	19.67		
	WATER	W_w	6.16	6.53	4.96	6.43		
	TARE		11.27	11.16	11.07	11.08		
	DRY SOIL	W_s	7.69	8.33	6.55	8.59		
	WATER CONTENT	w	80.1	78.4	75.7	74.9		
	NUMBER OF BLOWS		18	21	29	35		

LL __78.0__

PL __38.0__

PI __40.0__

Symbol from plasticity chart

MH

WATER CONTENT, W

NUMBER OF BLOWS

PLASTIC LIMIT

	RUN NO.		1	2	3	4	5	NATURAL WATER CONTENT
	TARE NO.		140A	150A				
WEIGHT IN GRAMS	TARE PLUS WET SOIL		24.07	30.71				
	TARE PLUS DRY SOIL		20.59	27.48				
	WATER	W_w	3.48	3.23				
	TARE		11.31	18.89				
	DRY SOIL	W_s	9.28	8.59				
	WATER CONTENT	w	37.5	37.6				
	PLASTIC LIMIT		37.6					

REMARKS ___Silt Clay (MH) (WINE)___

___Wash on No. 40 sieve___

TECHNICIAN ___BD___   COMPUTED BY ___BD___   CHECKED BY _____

BLENDED

LIQUID AND PLASTIC LIMIT TESTS

DATE __6-18-75__

PROJECT __La Pita Hill Sutdy, Panama Canal__

BORING NO. __ERE 27__   SAMPLE NO. __6__

LIQUID LIMIT

	RUN NO.		1	2	3	4	5	6
	TARE NO.		103A	110A	122A	128A		
WEIGHT IN GRAMS	TARE PLUS WET SOIL		25.22	26.35	25.33	26.05		
	TARE PLUS DRY SOIL		19.06	19.70	19.24	19.62		
	WATER	W w	6.16	6.65	6.09	6.43		
	TARE		11.22	11.01	11.06	10.84		
	DRY SOIL	W s	7.84	8.69	8.18	8.78		
	WATER CONTENT	w	78.6	76.5	74.4	73.2		
	NUMBER OF BLOWS		17	21	28	35		

LL __76.0__

PL __36.0__

PI __40.0__

Symbol from plasticity chart

__MH__

WATER CONTENT, W

NUMBER OF BLOWS

PLASTIC LIMIT

	RUN NO.		1	2	3	4	5	NATURAL WATER CONTENT
	TARE NO.		166A	168A				
WEIGHT IN GRAMS	TARE PLUS WET SOIL		31.93	32.14				
	TARE PLUS DRY SOIL		28.53	28.62				
	WATER	W w	3.40	3.52				
	TARE		18.99	18.72				
	DRY SOIL	W s	9.54	9.90				
	WATER CONTENT	w	35.6	35.6				
	PLASTIC LIMIT		35.6					

REMARKS __Silt Clay (Wine)__
Wash. on No. 40 sieve

TECHNICIAN __BD__   COMPUTED BY __BD__   CHECKED BY ____

ENG FORM 3838   (EM 1110-2-1906) (TRANSLUCENT)   GPO : 1966 OF—798-790   PLATE III-1
1 JUN 65

BLENDED

LIQUID AND PLASTIC LIMIT TESTS

DATE _____

PROJECT __La Pita Hill Study, Panama Canal__

BORING NO. __ERE-27__   SAMPLE NO. __7__

LIQUID LIMIT

		1	2	3	4	5	6
	RUN NO.						
	TARE NO.	153	172A	132A	113A		
WEIGHT IN GRAMS	TARE PLUS WET SOIL	20.11	26.62	18.53	19.00		
	TARE PLUS DRY SOIL	15.65	22.74	14.72	15.05		
	WATER W_w	4.46	3.88	3.81	3.95		
	TARE	11.35	18.85	10.34	10.92		
	DRY SOIL W_s	4.30	3.89	3.88	4.13		
	WATER CONTENT w	103.7	99.7	98.2	95.6		
	NUMBER OF BLOWS	17	23	28	34		

LL __99.0__

PL __57.0__

PI __42.0__

Symbol from plasticity chart

__MH__

WATER CONTENT, W

NUMBER OF BLOWS

PLASTIC LIMIT

		1	2	3	4	5	NATURAL WATER CONTENT
	RUN NO.						
	TARE NO.	174A	131				
WEIGHT IN GRAMS	TARE PLUS WET SOIL	28.56	21.05				
	TARE PLUS DRY SOIL	25.03	17.50				
	WATER W_w	3.53	3.55				
	TARE	18.79	11.29				
	DRY SOIL W_s	6.24	6.21				
	WATER CONTENT w	56.6	57.2				
	PLASTIC LIMIT	Avg. 56.9					

REMARKS __M.H. Gray Silt__
Wash. on No. 40 sieve

TECHNICIAN __EH__   COMPUTED BY __EH__   CHECKED BY _____

ENG FORM 3838 (EM 1110-2-1906) (TRANSLUCENT)   GPO : 1966 OF-798-790   PLATE III-1
1 JUN 65

LIQUID AND PLASTIC LIMIT TESTS

DATE **6-5-75**

PROJECT **La Pita Hill Study, Panama Canal**

BORING NO. **ERE-25A**   SAMPLE NO. **9**

LIQUID LIMIT

	RUN NO.	1	2	3	4	5	6
	TARE NO.	95A	95	79	62A		
WEIGHT IN GRAMS	TARE PLUS WET SOIL	20.90*	26.00	21.94	19.75		
	TARE PLUS DRY SOIL	16.42	18.88	17.28	15.84		
	WATER W_w	4.48	7.12	4.66	3.91		
	TARE g	11.23	10.45	11.49	10.86		
	DRY SOIL W_s	5.19	8.43	5.79	4.98		
	WATER CONTENT w	86.3	84.5	80.4	78.5		
	NUMBER OF BLOWS	17	22	28	34		

WATER CONTENT, w

NUMBER OF BLOWS

LL **82.0**

PL **34.0**

PI **48.0**

Symbol from plasticity chart

CH

PLASTIC LIMIT

	RUN NO.	1	2	3	4	5	NATURAL WATER CONTENT
	TARE NO.	5-A	56				
WEIGHT IN GRAMS	TARE PLUS WET SOIL	23.91	23.16				
	TARE PLUS DRY SOIL	20.65	20.22				
	WATER W_w	3.26	2.94				
	TARE	11.06	11.49				
	DRY SOIL W_s	9.59	8.73				
	WATER CONTENT w	34.0	33.8				
	PLASTIC LIMIT	Avg. 33.8					

REMARKS **Clay CH Brown**

Wash. on No. 40 sieve

TECHNICIAN **EH**   COMPUTED BY **EH**   CHECKED BY _____

ENG FORM **3838** 1 JUN 65   *(EM 1110-2-1906) (TRANSLUCENT)*   GPO : 1966 OF—798-790   PLATE III-1

BLENDED

LIQUID AND PLASTIC LIMIT TESTS

PROJECT La Pita Hill Study, Panama Canal

BORING NO. ERE -27   SAMPLE NO. 4

LIQUID LIMIT

		RUN NO.	1	2	3	4	5	6
		TARE NO.	52A	66A	97A	90A		
WEIGHT IN GRAMS		TARE PLUS WET SOIL	25.07	25.27	25.94	27.79		
		TARE PLUS DRY SOIL	18.04	18.29	18.63	19.65		
	W_w	WATER	7.03	6.98	7.31	8.14		
		TARE	11.11	11.27	11.13	10.86		
	W_s	DRY SOIL	6.93	7.02	7.50	8.79		
	w	WATER CONTENT	101.4	99.4	97.5	92.6		
		NUMBER OF BLOWS	15	21	27	35		

LL 98.0

PL 43.0

PI 55.0

Symbol from plasticity chart

MH

WATER CONTENT, W

NUMBER OF BLOWS

PLASTIC LIMIT

		RUN NO.	1	2	3	4	5	NATURAL WATER CONTENT
		TARE NO.	168A	169A	101	133		
WEIGHT IN GRAMS		TARE PLUS WET SOIL	28.26	29.40	19.10	19.34		
		TARE PLUS DRY SOIL	25.38	26.23	16.47	16.76		
	W_w	WATER	2.88	3.17	2.63	2.58		
		TARE	18.72	18.88	11.12	11.48		
	W_s	DRY SOIL	6.66	7.35	5.35	5.28		
	w	WATER CONTENT	43.2	43.1	49.2	48.9		
		PLASTIC LIMIT	43.2		49.1			

REMARKS Silt Fine Sand
Wash on No. 40 sieve

TECHNICIAN BD   COMPUTED BY BD   CHECKED BY

ENG FORM 3838 (EM 1110-2-1906) (TRANSLUCENT)   GPO : 1966 OF—798-790   PLATE III-1
1 JUN 65

B58

LA PITA HILL TEST RESULTS

PLASTICITY CHART

Plasticity Index

Liquid Limit

1	ERE–25A,	#8A
2	ERE–25A,	#11A
3	ERE–25A,	#11B
4	ERE–26,	#3
5	ERE–27,	#6
6	ERE–27,	#7
7	ERE–25A,	#9
8	ERE–27,	#4

A-Line

C-Line

CH

CL

MH & OH

ML & OL

CL-ML

B59

R-011953-C

APPENDIX C: EXAMPLES OF COMPUTER RUNS FOR CRITICAL SOLUTIONS

Semiempirical Stability Analysis Section
Prior to Canal Deepening

Strength	Pore Pressure	Acceleration
$c' = 0$, $\phi' = 20$ deg	$r_u = 0.23$	0.0
$c' = 600$ psf, $\phi' = 20$ deg	$r_u = 0.23$	0.0
$c' = 0$, $\phi' = 20$ deg	$r_u = 0.32$	0.0
$c' = 600$ psf, $\phi' = 20$ deg	$r_u = 0.32$	0.0

MORGENSTERN AND PRICE METHOD OF SLOPE STABILITY ANALYSIS - DON BANKS
LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

```
NUMBER OF POINTS    =   48

NUMBER OF LINES     =   48

NUMBER OF MATERIALS =    1


YDM =   185.00

XM  =   650.00

YDP =   415.00
```

POINT DESCRIPTION			
POINT NO.	NO.LINES.	X-COORDINATE	Y-COORDINATE
1	2	0.	150.00
2	2	240.00	150.00
3	2	290.00	159.00
4	3	466.50	165.00
5	2	658.00	170.00
6	2	686.00	179.00
7	2	726.00	181.00
8	2	766.00	190.00
9	2	795.00	200.00
10	2	829.00	210.00
11	2	856.00	220.00
12	2	890.00	230.00
13	2	905.00	250.00
14	2	933.00	250.00
15	2	955.00	260.00
16	2	975.00	270.00
17	2	996.00	280.00
18	2	1035.00	290.00
19	2	1072.00	300.00
20	2	1100.00	310.00
21	2	1125.00	320.00
22	2	1143.00	330.00
23	2	1158.00	340.00
24	2	1169.00	350.00
25	2	1175.00	360.00
26	2	1183.00	370.00
27	2	1192.00	380.00
28	2	1199.00	390.00
29	2	1202.00	400.00
30	2	1204.00	410.00
31	2	1205.00	415.00
32	2	1211.00	420.00
33	2	1221.00	450.00
34	2	1231.00	450.00
35	2	1246.00	450.00
36	2	1253.00	460.00
37	2	1360.00	460.00
38	2	1500.00	465.00
39	1	0.	165.00
40	4	525.00	237.00
41	2	678.00	260.00
42	2	632.00	276.80
43	2	1002.00	318.00
44	2	1119.00	351.20
45	1	1500.00	415.00
46	3	0.	600.00
47	2	625.00	600.00
48	1	1500.00	600.00

LINE DESCRIPTION			
LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	2	1
2	2	3	1
3	3	4	1
4	4	5	1
5	5	6	1
6	6	7	1
7	7	8	1
8	8	9	1
9	9	10	1
10	10	11	1
11	11	12	1
12	12	13	1
13	13	14	1
14	14	15	1
15	15	16	1
16	16	17	1
17	17	18	1
18	18	19	1
19	19	20	1
20	20	21	1
21	21	22	1
22	22	23	1
23	23	24	1
24	24	25	1
25	25	26	1
26	26	27	1
27	27	28	1
28	28	29	1
29	29	30	1
30	30	31	1
31	31	32	1
32	32	33	1
33	33	34	1
34	34	35	1
35	35	36	1
36	36	37	1
37	37	38	1
38	39	40	0
39	40	41	0
40	41	42	0
41	42	43	0
42	43	44	0
43	44	31	0
44	31	45	0
45	4	40	1
46	40	47	1
47	46	47	1
48	47	48	1

BxA	0.	240.000000	290.000000	466.510000	658.000000	688.000000	720.000000	760.000000
ByA	795.000000	829.000000	850.000000	890.010000	905.000000	933.000000	952.000000	975.000000
ByA	996.000000	1035.000000	1072.000000	1100.010000	1125.000000	1142.000000	1158.000000	1165.000000
ByA	1172.000000	1183.000000	1192.000000	1199.010000	1202.000000	1204.000000	1202.000000	1211.000000
ByA	1221.000000	1251.000000	1246.000000	1253.010000	1360.000000	1500.000000	0.	525.000000
BxA	678.000000	833.000000	1087.000000	1319.010000	1500.000000	0.	829.000000	1500.000000
ByA	482.750000	674.068871	650.000000					
BxB	0.	240.000000	290.000000	466.510000	482.750000	525.000000	650.000000	650.000000
ByB	674.068871	678.000000	680.000000	720.000000	766.000000	795.000000	829.000000	832.000000
ByB	850.000000	890.000000	905.000000	933.010000	955.000000	975.000000	996.000000	1007.000000
ByB	1035.000000	1072.000000	1100.000000	1119.010000	1125.000000	1142.000000	1158.000000	1165.000000
ByB	1172.000000	1183.000000	1192.000000	1199.000000	1202.000000	1204.000000	1202.000000	1211.000000
BxB	1221.000000	1251.000000	1246.000000	1253.000000	1360.000000	1500.000000		

X = 120.000000
BY =	120.000000	1
BY =	185.000000	45
BY =	196.885714	38

X = 265.000000
BY =	135.000000	2
BY =	185.000000	49
BY =	211.247420	38

X = 378.250000
BY =	162.500000	3
BY =	185.000000	49
BY =	222.464762	38

X = 474.625000
BY =	165.212141	4
BY =	175.000000	45
BY =	185.000000	49
BY =	232.010477	38

X = 503.875000
BY =	165.975645	4
BY =	185.000000	49
BY =	211.000000	45
BY =	234.907419	38

X = 587.500000
BY =	168.159269	4
BY =	185.000000	49
BY =	242.310457	39
BY =	311.629936	46

X = 654.000000
BY =	169.895562	4
BY =	247.960783	39
BY =	391.036186	46
BY =	415.000000	50

X = 666.034439
BY =	172.410332	5
BY =	249.983318	39
BY =	405.406258	46
BY =	415.000000	50

X = 676.034439
BY =	175.410332	5
BY =	249.632991	39
BY =	415.000000	50
BY =	417.347046	46

X = 663.000000
BY =	177.500000	5
BY =	250.864515	40
BY =	415.000000	50
BY =	425.664474	46

X = 704.000000

```
BY =    150.000000      6
BY =    255.495463     40
BY =     15.000000     50
BY =    453.740135     46
X =     743.000000
BY =    185.500000      7
BY =    261.238708     40
BY =    415.000000     50
BY =    494.309212     46
X =     780.500000
BY =    195.000000      8
BY =    267.722580     40
BY =    415.000000     50
BY =    542.087173     46
X =     812.000000
BY =    205.000000      9
BY =    273.169033     40
BY =    415.000000     50
BY =    579.700661     46
X =     831.000000
BY =    212.952381     10
BY =    279.454193     40
BY =    415.000000     50
X =     841.500000
BY =    215.952381     10
BY =    278.812645     41
BY =    415.000000     50
X =     870.000000
BY =    225.000000     11
BY =    285.560921     41
BY =    415.000000     50
X =     897.500000
BY =    234.999998     12
BY =    292.072414     41
BY =    415.000000     50
X =     919.000000
BY =    245.000000     13
BY =    297.163219     41
BY =    415.000000     50
X =     944.000000
BY =    225.000000     14
BY =    303.082760     41
BY =    415.000000     50
X =     965.000000
BY =    265.000000     15
BY =    309.055172     41
BY =    415.000000     50
X =     985.500000
BY =    275.000000     16
BY =    312.909195     41
BY =    415.000000     50
X =    1001.500000
BY =    281.410255     17
BY =    316.697700     41
BY =    415.000000     50
X =    1021.000000
BY =    286.410255     17
BY =    322.150002     42
BY =    415.000000     50
X =    1053.500000
BY =    295.000000     18
BY =    331.783928     42

BY =    412.000000     50
X =    1086.000000
BY =    305.000000     19
BY =    341.417858     42
BY =    412.000000     50
X =    1109.500000
BY =    313.799990     20
BY =    346.383930     42
BY =    415.000000     50
X =    1122.000000
BY =    318.799999     20
BY =    353.425583     43
BY =    412.000000     50
X =    1133.500000
BY =    325.000000     21
BY =    361.956978     43
BY =    412.000000     50
X =    1150.000000
BY =    335.000000     22
BY =    374.197678     43
BY =    412.000000     50
X =    1163.500000
BY =    344.999999     23
BY =    384.212791     43
BY =    415.000000     50
X =    1172.000000
BY =    324.999990     24
BY =    390.518608     43
BY =    415.000000     50
X =    1179.000000
BY =    365.000000     25
BY =    395.711628     43
BY =    415.000000     50
X =    1187.500000
BY =    375.000000     26
BY =    402.917445     43
BY =    415.000000     50
X =    1195.500000
BY =    385.000000     27
BY =    407.952328     43
BY =    415.000000     50
X =    1200.500000
BY =    394.799992     28
BY =    411.661629     43
BY =    415.000000     50
X =    1203.000000
BY =    405.000000     29
BY =    413.516281     43
BY =    415.000000     50
X =    1204.500000
BY =    412.500000     30
BY =    414.629070     43
BY =    415.000000     50
X =    1208.000000
BY =    415.000000     50
BY =    417.499996     31
X =    1216.000000
BY =    415.000000     50
BY =    425.000000     32
X =    1226.000000
BY =    415.000000     50
BY =    435.000000     33
X =    1238.500000
BY =    415.000000     50
BY =    445.000000     34
X =    1249.500000
BY =    415.000000     50
BY =    655.000004     35
X =    1306.500000
BY =    415.000000     50
BY =    660.300000     36
X =    1430.000000
BY =    415.000000     50
BY =    462.500000     37
```

NO. OF POINTS TO DESCRIBE FAILURE SURFACES	=	4
NO. OF FAILURE SURFACE DESCRIPTION CARDS	=	1
MAX. NO. OF COLUMNS TO DESCRIBE FAIL. SURF.	=	4
NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES	=	3
NO. OF ALTERNATE F(X) DISTRIBUTIONS	=	0

FAILURE SURFACE POINTS

POINT NO.	X-COORDINATE	Y-COORDINATE	F(X)
1	466.50	164.10	1.00
	0.00	682.00	423.00
	1.00	1.00	1221.00
	460.00	1.00	0.00
	1253.20	429.80	1.00

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE			
1	1	2	3	4

SOIL DATA

NO	WET	SAT	COH	FI	NU	EQ
1	132.0	132.0	0.	0.364	0.290	0.

SURFACE NUMBER   1 ,   1 (SPECIFIED)

SURFACE DEFINED BY #	POINT	X	Y	F(X)
	1 - 1	460.50	164.90	1.00
	2 - 2	692.90	425.00	1.00
	3 - 3	1221.00	460.00	1.00
	4 - 4	1255.20	459.90	1.00

$_{1}$NS,IT   0   0
INS,IT   0   2

X-COORD.		E	X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
482.73	7323.	7323.	5019.	3.85	0.151	0.53	1.80	1.00	0.
483.38	7889.	7889.	5407.	3.96	0.151	0.53	1.80	1.00	589.55
525.00	96353.	96368.	66045.	11.35	0.151	0.53	1.80	1.00	607.33
526.89	102728.	102728.	71408.	11.69	0.151	0.53	1.80	1.00	2122.70
650.00	951734.	751964.	652456.	32.54	0.151	0.53	1.80	1.00	2191.64
658.00	1036859.	1036859.	71642.	31.96	0.151	0.53	1.00	1.00	6671.66
674.07	1238292.	1238292.	841699.	39.23	0.164	0.53	1.00	1.00	6962.79
675.32	1254542.	1254542.	857836.	39.63	0.165	0.53	1.00	1.00	7410.91
678.00	1289483.	1289483.	883785.	40.47	0.167	0.53	1.00	1.00	7449.89
682.00	1342343.	1342343.	920013.	41.72	0.170	0.53	1.00	1.00	7520.54
683.00	1319061.	1319061.	904057.	39.99	0.164	0.53	1.00	1.00	7632.09
720.00	1127302.	1127302.	772629.	27.03	0.111	0.53	1.00	1.00	7589.01
766.00	908911.	908911.	622948.	11.75	0.045	0.53	1.00	1.00	7595.25
795.00	812279.	812279.	556719.	1.63	0.016	0.53	1.00	1.00	7414.02
823.00	688471.	690471.	471863.	-6.95	-0.031	0.53	1.00	1.00	7165.45
833.00	680119.	690119.	466139.	-7.36	-0.033	0.53	1.80	1.00	6927.56
859.00	645303.	645303.	442277.	-9.27	-0.043	0.53	1.00	1.00	6876.95
895.00	496323.	496323.	341169.	-26.47	-0.128	0.53	1.00	1.00	6661.90
905.00	488965.	483916.	333093.	-23.13	-0.117	0.53	1.00	1.00	6436.02
933.00	414119.	414149.	283949.	-31.96	-0.168	0.53	1.00	1.00	6158.35
955.00	372470.	372470.	255283.	-35.43	-0.195	0.53	1.00	1.00	5907.64
975.00	342217.	342217.	234548.	-37.15	-0.215	0.53	1.00	1.00	5644.12
996.00	308904.	308904.	211716.	-41.46	-0.246	0.53	1.00	1.00	5376.32
1007.00	277556.	277556.	190231.	-47.97	-0.295	0.53	1.00	1.00	5110.67
1035.00	199545.	199545.	136765.	-71.07	-0.465	0.53	1.00	1.00	5046.58
1072.00	103435.	103435.	7,893.	-131.89	-0.927	0.53	1.00	1.00	4883.45
1100.00	47337.	47337.	32444.	-281.17	-1.843	0.53	1.00	1.00	4651.96
1119.00	15209.	15209.	10465.	-695.13	-5.058	0.53	1.00	1.00	4401.25
1125.00	5435.	5442.	3732.	-1801.57	-13.521	0.53	1.00	1.00	4205.84
1142.00	-6135.	-6135.	-4237.	1171.23	9.389	0.53	1.00	1.00	4144.14
1153.00	-13792.	-13792.	-9453.	351.73	3.065	0.53	1.00	1.00	3869.94
1167.00	-5912.	-5942.	-4073.	439.38	4.595	0.53	1.80	1.00	3593.60
1175.00	14865.	14862.	10168.	-89.68	-0.915	0.53	1.00	1.00	3306.59
1183.00	28786.	28786.	19730.	-3.69	-0.042	0.53	1.00	1.00	3008.91
1192.00	39063.	39065.	26776.	12.70	0.252	0.53	1.00	1.00	2715.49
1199.00	52104.	52104.	35711.	27.02	0.394	0.53	1.00	1.00	2424.21
1202.00	70245.	70245.	48144.	27.40	0.466	0.53	1.00	1.00	2128.66
1204.00	87029.	87029.	59647.	25.18	0.335	0.53	1.00	1.00	1824.56
1205.00	94266.	94266.	64608.	25.36	0.377	0.53	1.00	1.00	1518.33
1211.00	90757.	90767.	62211.	25.09	0.386	0.53	1.00	1.00	1369.22
1220.00	82514.	82514.	55621.	15.93	0.611	0.53	1.00	1.00	1294.54
1221.00	80925.	80925.	55464.	15.46	0.515	0.53	1.00	1.00	1163.48
1231.00	50723.	50723.	41518.	15.46	0.575	0.53	1.00	1.00	1146.59
1245.00	28877.	28877.	19793.	9.44	0.553	0.53	1.00	1.00	977.74
1252.96	-0.	-0.	-0.	3.	0.	0.	1.00	1.00	807.96

F = 1.246   LAMBDA = 0.695(3 7   0)

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	500.0	0.361	0.280	0.

C8

SURFACE NUMBER   1 ,   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	1 -	1	466,50	164,80	1,00
	2 -	2	682,80	423,60	1,00
	3 -	3	1223,00	460,00	1,00
	4 -	4	1253,20	459,80	1,00

INS,IT   U 0
INS,IT   U 2

X-COORD,	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
482,79	-1152,	-1162,	-770,	11,11	0,695	-14,13	1,00	1,30	0,
483,36	-9,4,	-904,	-599,	17,11	0,875	-19,03	1,00	1,70	585,15
525,00	68927,	68927,	45712,	9,52	0,125	1,45	1,00	1,30	607,53
526,89	74521,	74551,	43442,	4,90	0,126	1,41	1,00	1,30	2122,70
650,00	396765,	396765,	594737,	32,13	0,150	0,77	1,00	1,30	2191,54
658,00	981329,	381329,	653817,	31,61	0,150	0,76	1,00	1,30	6671,46
674,07	1182355,	1182366,	784158,	33,15	0,164	0,73	1,00	1,30	6962,79
675,32	1198629,	1198629,	794930,	33,56	0,165	0,73	1,00	1,30	7410,91
678,00	1235565,	1235566,	818101,	40,44	0,167	0,73	1,00	1,30	7445,39
682,00	1286445,	1286446,	855171,	41,74	0,170	0,72	1,00	1,30	7520,54
608,00	1265409,	1265409,	839219,	41,16	0,164	0,72	1,00	1,30	7632,39
720,00	1087288,	1087288,	721089,	27,87	0,114	0,75	1,00	1,30	7589,01
766,00	886628,	886628,	589012,	12,95	0,054	0,79	1,00	1,30	7595,25
795,00	799495,	799495,	531225,	6,90	0,030	0,81	1,00	1,30	7414,02
829,00	696258,	696258,	455126,	=2,18	=0,010	0,84	1,00	1,30	7169,45
833,00	678931,	678931,	450267,	=2,44	=0,011	0,84	1,00	1,30	6927,56
850,00	648232,	648232,	423907,	=3,69	=0,017	0,85	1,00	1,30	6876,25
890,00	509764,	509764,	339075,	=19,13	=0,087	0,92	1,00	1,30	6661,90
905,30	504677,	504677,	334702,	=14,62	=0,974	0,90	1,00	1,33	6436,82
933,00	435052,	435052,	288526,	=21,45	=0,113	0,94	1,00	1,30	6158,35
955,00	396405,	396405,	262895,	=23,70	=0,130	0,96	1,00	1,30	5907,54
975,00	368176,	368176,	244174,	=24,58	=0,142	0,97	1,00	1,30	5644,12
995,00	336452,	336462,	223141,	=25,80	=0,163	0,99	1,00	1,30	5376,12
1007,00	306124,	306124,	203021,	=33,49	=0,200	1,03	1,00	1,30	5110,57
1035,00	230318,	230318,	152747,	=55,18	=0,319	1,17	1,00	1,30	5046,58
1072,00	136203,	136203,	91330,	=87,51	=0,564	1,54	1,00	1,30	4883,45
1100,00	80507,	80507,	55392,	=123,42	=0,913	2,14	1,00	1,30	4651,26
1119,00	48131,	48131,	31921,	=184,46	=1,362	3,09	1,00	1,30	4401,25
1125,00	38124,	38124,	25294,	#217,24	=1,643	3,72	1,00	1,30	4209,34
1142,00	25274,	25274,	19762,	=241,02	=1,934	5,01	1,00	1,70	4144,14
1158,00	15985,	15985,	13601,	=293,01	=2,186	7,10	1,00	1,30	3869,94
1169,00	22032,	22032,	14611,	=102,18	=0,760	4,92	1,00	1,30	3593,69
1175,00	41296,	41296,	27361,	=17,37	=0,190	2,67	1,00	1,30	3306,59
1183,00	53180,	53180,	33269,	5,34	0,073	2,04	1,00	1,30	3008,91
1192,00	61083,	61083,	41513,	17,94	0,230	1,71	1,00	1,30	2715,49
1199,00	71941,	71940,	47711,	22,99	0,335	1,41	1,00	1,30	2424,21
1202,00	88734,	88734,	53848,	24,12	0,411	1,15	1,00	1,30	2128,66
1204,00	104435,	104435,	63262,	23,71	0,485	0,97	1,00	1,30	1824,56
1205,00	111141,	111141,	73709,	23,21	0,528	0,91	1,00	1,30	1518,53
1211,00	105574,	105574,	71017,	21,23	0,539	0,89	1,00	1,30	1365,22
1220,00	94297,	94297,	62538,	17,56	0,566	0,85	1,00	1,30	1294,54
1221,00	92254,	92254,	61163,	17,13	0,571	0,84	1,00	1,30	1163,48
1231,00	68510,	68510,	45436,	12,49	0,626	0,81	1,00	1,00	1146,59
1244,00	31114,	31114,	20635,	5,14	0,522	0,84	1,00	1,00	977,74
1252,84	-0,	-0,	-0,	0,	0,	0,	1,00	1,00	807,96

F =   1,373 LAMBDA =   0,663(4 6 8)

SOIL DATA

NO	WET	SAT	COH	FI	RJ	EQ
1	135,0	135,0	0,	0,364	0,520	0,

SURFACE NUMBER   1 ,   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	1 –	1	665.50	164.80	1.00
	2 –	2	682.80	425.00	1.00
	3 –	3	1221.00	460.00	1.00
	4 –	4	1253.20	459.80	1.00

INS.IT   1 –1
NOT CONVERGING   2   1

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
482.79	8555.	8565.	2570.	4.94	0.262	1.21	1.00	1.30	0.
483.36	9227.	9227.	2768.	5.13	0.262	1.21	1.00	1.30	814.13
525.00	112712.	112712.	33814.	17.92	0.262	1.21	1.00	1.30	844.98
526.89	120122.	120192.	36045.	18.50	0.262	1.21	1.00	1.30	2953.32
650.00	1113424.	1113424.	334027.	56.31	0.262	1.21	1.00	1.30	3049.23
658.00	1212719.	1212718.	363815.	53.77	0.262	1.21	1.00	1.30	9282.31
674.07	1458984.	1458984.	437695.	65.88	0.276	1.21	1.00	1.30	9687.36
675.32	1478830.	1478850.	443655.	65.43	0.277	1.21	1.00	1.30	10310.83
678.00	1521569.	1521569.	456470.	67.29	0.279	1.21	1.80	1.50	10359.49
682.00	1586194.	1586194.	475858.	67.33	0.282	1.21	1.00	1.30	10463.36
688.00	1581947.	1581947.	474584.	69.61	0.285	1.21	1.00	1.30	10618.56
720.00	1474732.	1474732.	442419.	68.75	0.281	1.21	1.00	1.30	10558.63
766.00	1389797.	1389797.	416939.	71.16	0.294	1.21	1.00	1.32	10567.30
795.00	1384034.	1384034.	415210.	72.34	0.313	1.21	1.00	1.30	10315.16
829.00	1399685.	1399685.	437905.	73.88	0.331	1.21	1.00	1.30	9969.32
833.00	1364251.	1364251.	409275.	74.20	0.335	1.21	1.00	1.30	9638.34
850.00	1383284.	1383284.	414985.	75.29	0.351	1.21	1.00	1.30	9567.94
893.00	1339713.	1339713.	401913.	73.51	0.364	1.21	1.00	1.30	9268.73
905.00	1381721.	1381721.	414516.	76.23	0.384	1.21	1.00	1.30	8955.47
933.00	1380166.	1380166.	414050.	75.75	0.398	1.21	1.00	1.30	8568.13
955.00	1397149.	1397149.	419144.	73.12	0.413	1.21	1.00	1.30	8219.32
975.00	1419223.	1419223.	425767.	74.16	0.428	1.21	1.00	1.00	7852.68
996.00	1437435.	1437435.	431230.	72.68	0.442	1.21	1.00	1.20	7480.10
1007.00	1428669.	1428669.	428600.	71.72	0.441	1.21	1.00	1.30	7110.30
1035.00	1406851.	1406851.	422055.	69.12	0.439	1.21	1.00	1.30	7021.33
1072.00	1382754.	1382754.	414826.	65.38	0.436	1.21	1.00	1.30	6794.56
1100.00	1381587.	1381587.	414476.	62.28	0.439	1.21	1.00	1.30	6472.29
1119.00	1385974.	1385974.	415792.	59.98	0.443	1.21	1.00	1.30	6123.48
1125.00	1387319.	1387319.	416195.	59.21	0.444	1.21	1.00	1.30	5851.61
1142.00	1409778.	1409778.	422933.	56.92	0.457	1.21	1.00	1.30	5765.75
1159.00	1432683.	1432683.	429805.	51.51	0.471	1.21	1.00	1.30	5384.26
1169.00	1443054.	1463054.	433916.	52.69	0.495	1.21	1.00	1.30	4999.30
1175.00	1499265.	1499265.	447780.	51.54	0.532	1.21	1.00	1.10	4600.18
1183.00	1529038.	1529038.	458711.	49.90	0.571	1.21	1.00	1.30	4186.30
1192.00	1554399.	1554399.	466319.	47.98	0.614	1.21	1.00	1.30	3778.27
1199.00	1579291.	1579291.	473787.	45.35	0.676	1.21	1.00	1.30	3372.91
1202.00	1605119.	1605119.	481535.	43.46	0.774	1.21	1.00	1.30	2961.61
1204.00	1627850.	1627850.	438355.	44.75	0.915	1.21	1.00	1.00	2538.52
1205.00	1637653.	1637653.	491296.	44.40	1.010	1.21	1.00	1.10	2112.46
1211.00	1637944.	1637944.	491383.	43.05	1.093	1.21	1.00	1.00	1899.43
1220.00	1635981.	1635981.	490794.	41.02	1.323	1.21	1.00	1.00	1801.10
1221.00	1635162.	1635162.	490548.	40.73	1.358	1.21	1.00	1.30	1619.75
1231.00	1623807.	1623807.	487142.	37.86	1.499	1.21	1.00	1.30	1595.26
1246.00	1603131.	1503131.	483939.	31.63	3.417	1.21	1.00	1.00	1360.34
1252.96	1582445.	1582445.	474733.	1.	0.	0.	1.00	1.00	1124.11

F =   1.500   LAMBDA =   0.300(0   20   0)

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	500.0	0.364	0.320	0.

SURFACE NUMBER   1 ,   1 (SPECIFIED)

SURFACE DEFINED BY:	POINT	X	Y	F(X)
1-	1	466.50	164.50	1.00
2-	2	682.20	425.90	1.00
3-	3	1220.00	460.80	1.00
4-	4	1253.20	459.80	1.00

INS.IT U 0
INS.IT V 2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
482.79	-1939.	=1939.	-2685.	=3.34	=0.177	=3.95	1.00	1.00	0.
483.36	-1915.	=1815.	-2515.	=3.76	=0.192	=4.40	1.00	1.00	814.13
525.00	40503.	40505.	56099.	=1.24	=0.018	0.99	1.00	1.00	844.78
526.89	44021.	44021.	60908.	=1.36	=0.019	0.96	1.00	1.00	2953.52
650.00	569337.	569397.	788544.	=7.83	=0.036	0.43	1.00	1.00	3049.23
655.00	623729.	623728.	863846.	=9.23	=0.037	0.42	1.00	1.00	9282.31
674.07	761771.	761771.	1055032.	=2.14	=0.009	0.40	1.00	1.00	9687.36
675.32	772925.	772925.	1070480.	=1.74	=0.007	0.40	1.00	1.00	10310.93
678.00	796918.	796918.	1103709.	=0.91	=0.004	0.39	1.00	1.00	10359.49
682.00	833237.	833237.	1154009.	0.25	0.001	0.39	1.00	1.00	10463.36
684.00	816967.	816967.	1131476.	=4.87	=0.020	0.39	1.00	1.00	10618.56
720.00	617822.	617822.	855666.	=51.16	=0.209	0.43	1.00	1.00	10558.43
766.00	424159.	424159.	587448.	=122.06	=0.511	0.51	1.00	1.00	10567.50
795.00	366539.	366539.	507646.	=149.93	=0.650	0.54	1.00	1.00	10315.16
829.00	276821.	276821.	383390.	=211.30	=0.943	0.61	1.00	1.00	9969.32
833.00	276234.	276234.	382577.	=203.66	=0.942	0.61	1.00	1.00	9638.54
850.00	273578.	273578.	378998.	=202.79	=0.945	0.60	1.00	1.00	9567.94
890.00	151135.	151135.	209318.	=377.36	=1.820	0.86	1.00	1.00	9268.73
905.00	183381.	183381.	253977.	=283.57	=1.415	0.73	1.00	1.00	8955.57
933.00	138325.	138325.	191570.	=355.84	=1.870	0.86	1.00	1.00	8568.13
955.00	127966.	127966.	177229.	=355.34	=1.960	0.88	1.00	1.00	8219.32
975.00	128169.	128169.	177511.	=329.01	=1.900	0.85	1.00	1.00	7852.68
996.00	122611.	122611.	169813.	=321.95	=1.956	0.84	1.00	1.00	7480.10
1007.00	95626.	95626.	132439.	=412.27	=2.537	1.00	1.00	1.00	7110.50
1035.00	28072.	28072.	38879.	=1344.12	=8.546	2.69	1.00	1.00	7021.33
1072.00	-53816.	=53816.	-74533.	594.63	3.969	=0.94	1.00	1.00	6794.36
1100.00	-92079.	=92079.	-127527.	265.43	1.894	=0.40	1.00	1.00	6472.29
1119.00	-110526.	-110526.	-153076.	172.17	1.271	=0.27	1.00	1.00	6123.48
1125.00	-116292.	-116292.	=161061.	147.87	1.108	=0.23	1.00	1.00	5851.61
1142.00	-107399.	-107399.	=148745.	183.33	0.829	=0.24	1.00	1.00	5765.75
1158.00	=96023.	=96023.	=132989.	62.78	0.525	=0.26	1.00	1.00	5384.26
1169.00	=68294.	=68294.	=94585.	29.02	0.273	=0.41	1.00	1.00	4999.90
1175.00	=26731.	=26781.	=37091.	=23.38	=0.241	=1.30	1.00	1.00	4600.48
1183.00	4304.	4304.	59601.	593.99	6.849	9.07	1.00	1.00	4186.50
1192.00	28853.	28853.	39960.	133.77	1.713	1.44	1.00	1.00	3778.07
1199.00	55123.	55123.	76344.	84.04	1.226	0.80	1.00	1.00	3372.41
1202.00	86675.	86675.	120043.	60.31	1.026	0.56	1.00	1.00	2961.01
1204.00	115132.	115132.	159455.	43.54	0.993	0.45	1.00	1.00	2538.52
1205.00	127318.	127318.	176327.	44.47	1.011	0.41	1.00	1.00	2112.46
1211.00	122694.	122694.	169928.	33.74	0.984	0.40	1.00	1.00	1899.43
1220.00	112701.	112701.	156088.	27.79	0.961	0.35	1.00	1.00	1801.10
1221.00	110471.	110471.	153000.	29.91	0.964	0.38	1.00	1.00	1618.75
1231.00	83478.	83478.	115615.	21.37	1.022	0.37	1.00	1.00	1595.26
1246.00	37866.	37866.	52443.	5.93	0.704	0.38	1.00	1.00	1360.34
1252.84	0.	0.	0.	0.	0.	0.	1.00	1.00	1124.11

F = 1.301   LAMBDA =   1.385(8 10   0)
STOP AT LINE   9.....

Semiempirical Stability Analysis Section
After Canal Deepening

Strength	Pore Pressure	Acceleration
$c' = 0$, $\phi' = 20$ deg	$r_u = 0.23$	0.0
$c' = 600$ psf, $\phi' = 20$ deg	$r_u = 0.23$	0.0
$c' = 0$, $\phi' = 20$ deg	$r_u = 0.32$	0.0
$c' = 600$ psf, $\phi' = 20$ deg	$r_u = 0.32$	0.0

EXAMPLE NO. 2

Semiempirical Stability Analysis Section
After Canal Deepening

Strength	Pore Pressure	Acceleration
$c' = 0$, $\phi' = 20$ deg	$r_u = 0.23$	0.0
$c' = 600$ psf, $\phi' = 20$ deg	$r_u = 0.23$	0.0
$c' = 0$, $\phi' = 20$ deg	$r_u = 0.32$	0.0
$c' = 600$ psf, $\phi' = 20$ deg	$r_u = 0.32$	0.0

MORGENSTERN AND PRICE METHOD OF SLOPE STABILITY ANALYSIS - DON BANKS

LI PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NUMBER OF POINTS   =   48

NUMBER OF LINES   =   48

NUMBER OF MATERIALS =   1

YDM =   185.00

XM =   650.00

YDP =   415.00

	POINT DESCRIPTION					LINE DESCRIPTION		
POINT NO.	NO.LINES.	X-COORDINATE	Y-COORDINATE		LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	0.	150.00		1	1	2	1
2	2	240.00	150.00		2	2	3	1
3	2	290.00	160.00		3	3	4	1
4	3	466.50	165.00		4	4	5	1
5	2	658.00	170.00		5	5	6	1
6	2	688.00	179.00		6	6	7	1
7	2	720.00	181.00		7	7	8	1
8	2	766.00	190.00		8	8	9	1
9	2	795.00	200.00		9	9	10	1
10	2	829.00	210.00		10	10	11	1
11	2	850.00	220.00		11	11	12	1
12	2	890.00	230.00		12	12	13	1
13	2	905.00	240.00		13	13	14	1
14	2	933.00	250.00		14	14	15	1
15	2	955.00	260.00		15	15	16	1
16	2	975.00	270.00		16	16	17	1
17	2	996.00	280.00		17	17	18	1
18	2	1035.00	290.00		18	18	19	1
19	2	1072.00	300.00		19	19	20	1
20	2	1100.00	310.00		20	20	21	1
21	2	1125.00	320.00		21	21	22	1
22	2	1142.00	330.00		22	22	23	1
23	2	1158.00	340.00		23	23	24	1
24	2	1169.00	350.00		24	24	25	1
25	2	1175.00	360.00		25	25	26	1
26	2	1183.00	370.00		26	26	27	1
27	2	1192.00	380.00		27	27	28	1
28	2	1199.00	390.00		28	28	29	1
29	2	1202.00	400.00		29	29	30	1
30	2	1204.00	410.00		30	30	31	1
31	4	1205.00	415.00		31	31	32	1
32	2	1211.00	420.00		32	32	33	1
33	2	1221.00	430.00		33	33	34	1
34	2	1231.00	440.00		34	34	35	1
35	2	1246.00	450.00		35	35	36	1
36	2	1253.00	460.00		36	36	37	1
37	2	1360.00	460.00		37	37	36	1
38	1	1500.00	465.00		38	39	40	0
39	1	0.	185.00		39	40	41	0
40	4	525.00	237.00		40	41	42	0
41	2	678.00	250.00		41	42	43	0
42	2	833.00	276.80		42	43	44	0
43	2	1007.00	318.00		43	44	31	0
44	2	1119.00	351.20		44	31	45	0
45	1	1500.00	415.00		45	4	40	1
46	1	0.	600.00		46	40	47	1
47	3	829.00	600.00		47	46	47	1
48	1	1500.00	600.00		48	47	48	1

BVA	0.	240.000000	290.000000	466.500000	658.000000	688.000000	720.000000	766.000000
BVA	795.000000	829.000000	850.000000	890.000000	905.000000	933.000000	955.000000	975.000000
BVA	996.000000	1035.000000	1072.000000	1100.000000	1125.000000	1142.000000	1158.000000	1169.000000
BVA	1175.000000	1183.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000
BVA	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000	0.	525.000000
BVA	678.000000	833.000000	1007.000000	1319.000000	1500.000000	0.	829.000000	1500.000000
BVA	482.750000	674.068871	650.000000					
BVB	0.	240.000000	290.000000	466.500000	482.750000	525.000000	656.000000	658.000000
BVB	674.068871	678.000000	686.000000	720.000000	766.000000	795.000000	829.000000	833.000000
BVB	850.000000	890.000000	905.000000	933.000000	955.000000	975.000000	996.000000	1007.000000
BVB	1035.000000	1072.000000	1100.000000	1119.000000	1125.000000	1142.000000	1158.000000	1169.000000
BVB	1175.000000	1183.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000
BVB	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000		

```
X =   120.000000
  ÂY =   150.000000      1
  BŶ =   185.000000     49
  BŶ =   196.885714     38
X =   265.000000
  ÂY =   155.000000      2
  BŶ =   185.000000     49
  BŶ =   211.247620     38
X =   378.250000
  ÂY =   162.500000      3
  BŶ =   185.000000     49
  BŶ =   222.464762     38
X =   474.625000
  ÂY =   165.212141      4
  BŶ =   175.000000     45
  BŶ =   185.000000     49
  BŶ =   232.010477     38
X =   503.875000
  ÂY =   165.975849      4
  BŶ =   185.000000     49
  BŶ =   211.000000     45
  BŶ =   234.907619     38
X =   587.500000
  ÂY =   168.159269      4
  BŶ =   185.000000     49
  BŶ =   242.310457     39
  BŶ =   311.629936     46
X =   654.000000
  ÂY =   169.895561      4
  BŶ =   247.960783     39
  BŶ =   391.036186     46
  BŶ =   415.000000     50
X =   666.034439
  ÂY =   172.410332      5
  BŶ =   248.983318     39
  BŶ =   405.406258     46
  BŶ =   415.000000     50
X =   676.034439
  ÂY =   175.410332      5
  BŶ =   249.832991     39
  BŶ =   415.000000     50
  BŶ =   417.347046     46
X =   683.000000
  ÂY =   177.500000      5
  BŶ =   250.864535     40
  BŶ =   415.000000     50
  BŶ =   425.664474     46
X =   704.000000
```

```
ẤY =    180.000000     6
Bȳ =    254.495483    40
Bȳ =    415.000000    50
Bȳ =    450.740135    46
X =     743.000000
ẤY =    185.500000     7
Bȳ =    261.238708    40
Bȳ =    415.000000    50
Bȳ =    497.309212    46
X =     780.500000
ẤY =    195.000000     8
Bȳ =    267.722580    40
Bȳ =    415.000000    50
Bȳ =    542.087173    46
X =     812.000000
ẤY =    205.000000     9
Bȳ =    273.169033    40
Bȳ =    415.000000    50
Bȳ =    579.700661    46
X =     831.000000
ẤY =    210.952381    10
Bȳ =    276.454193    40
Bȳ =    415.000000    50
X =     841.500000
ẤY =    215.952381    10
Bȳ =    278.812645    41
Bȳ =    415.000000    50
X =     870.000000
ẤY =    225.000000    11
Bȳ =    285.560921    41
Bȳ =    415.000000    50
X =     897.500000
ẤY =    234.999998    12
Bȳ =    292.072414    41
Bȳ =    415.000000    50
X =     919.000000
ẤY =    245.000000    13
Bȳ =    297.163219    41
Bȳ =    415.000000    50
X =     944.000000
ẤY =    255.000000    14
Bȳ =    303.082760    41
Bȳ =    415.000000    50
X =     945.000000
ẤY =    265.000000    15
Bȳ =    308.055172    41
Bȳ =    415.000000    50
X =     985.500000
ẤY =    275.000000    16
Bȳ =    312.909195    41
Bȳ =    415.000000    50
X =    1001.500000
ẤY =    281.410255    17
Bȳ =    316.697700    41
Bȳ =    415.000000    50
X =    1021.000000
ẤY =    286.410255    17
Bȳ =    322.150002    42
Bȳ =    415.000000    50
X =    1053.500000
ẤY =    295.000000    18
Bȳ =    331.783928    42

Bȳ =    415.000000    50
X =    1086.000000
ẤY =    305.000000    19
Bȳ =    341.417858    42
Bȳ =    415.000000    50
X =    1109.500000
ẤY =    313.799999    20
Bȳ =    348.383930    42
Bȳ =    415.000000    50
X =    1122.000000
ẤY =    318.799999    20
Bȳ =    353.425583    43
Bȳ =    415.000000    50
X =    1133.500000
ẤY =    325.000000    21
Bȳ =    361.956978    43
Bȳ =    415.000000    50
X =    1150.000000
ẤY =    335.000000    22
Bȳ =    374.197678    43
Bȳ =    415.000000    50
X =    1163.500000
ẤY =    344.999996    23
Bȳ =    384.212791    43
Bȳ =    415.000000    50
X =    1172.000000
ẤY =    354.999996    24
Bȳ =    390.518608    43
Bȳ =    415.000000    50
X =    1179.000000
ẤY =    365.000000    25
Bȳ =    395.711628    43
Bȳ =    415.000000    50
X =    1187.500000
ẤY =    375.000000    26
Bȳ =    402.017445    43
Bȳ =    415.000000    50
X =    1195.500000
ẤY =    385.000000    27
Bȳ =    407.952328    43
Bȳ =    415.000000    50
X =    1200.500000
ẤY =    394.999992    28
Bȳ =    411.661629    43
Bȳ =    415.000000    50
X =    1203.000000
ẤY =    405.000000    29
Bȳ =    413.516281    43
Bȳ =    415.000000    50
X =    1204.500000
ẤY =    412.500000    30
Bȳ =    414.629070    43
Bȳ =    415.000000    50
X =    1208.000000
ẤY =    415.000000    50
Bȳ =    417.499996    31
X =    1216.000000
ẤY =    415.000000    50
Bȳ =    425.000000    32
X =    1226.000000
ẤY =    415.000000    50
Bȳ =    435.000000    33

X =    1238.500000
ẤY =    415.000000    50
Bȳ =    449.000000    34
X =    1249.500000
ẤY =    415.000000    50
Bȳ =    455.000004    35
X =    1306.500000
ẤY =    415.000000    50
Bȳ =    460.000000    36
X =    1430.000000
ẤY =    415.000000    50
Bȳ =    462.500000    37
```

NO. OF POINTS TO DESCRIBE FAILURE SURFACES = 10

NO. OF FAILURE SURFACE DESCRIPTION CARDS = 6

MAX. NO. OF COLUMNS TO DESCRIBE FAIL. SURF.= 5

NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES = 3

NO. OF ALTERNATE F(X) DISTRIBUTIONS = 0

FAILURE SURFACE POINTS

POINT NO.	X-COORDINATE	Y-COORDINATE	F(X)
1	466.50	164.60	1.00
0.00	695.00	440.00	
1.00	6.00	1140.00	
470.00	1.00	0.00	
1240.00	470.00	1.00	
0.00	1253.00	459.80	
1.00	0.00	695.00	
440.00	5.00	0.00	
695.00	440.00	0.50	
0.00	695.00	440.00	
0.10	6.00	695.00	
440.00	2.00	0.00	
695.00	440.00	10.00	

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE				
1	1	2	3	4	5
2	1	6	3	4	5
3	1	7	3	4	5
4	1	8	3	4	5
5	1	9	3	4	5
6	1	10	3	4	5

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	0.	0.364	0.230	0.

C17

SURFACE NUMBER   1 .   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	1-	1	466.50	164.80	1.00
	2-	2	695.00	440.00	1.00
	3-	3	1140.00	470.00	1.00
	4-	4	1240.00	470.00	1.00
	5-	5	1253.00	459.80	1.00

INS.IT   0 0
INS.IT   0 2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-2	VERT F	SMALL F		PORE PRES
482.75	7947.	7947.	4323.	3.64	8.192	0.67	1.00	1.00	0,
483.27	8471.	8471.	4609.	3.76	8.192	0.67	1.00	1.00	588,30
525.00	104568.	104568.	56886.	13.20	8.192	0.67	1.00	1.00	607.40
526.56	110229.	110229.	59965.	13.55	8.192	0.67	1.00	1.00	2134.02
650.00	1032953.	1032953.	561933.	41.47	8.192	0.67	1.00	1.00	2191.02
658.00	1125070.	1125070.	612046.	43.28	8.192	0.67	1.00	1.00	6707.17
674.07	1343356.	1343356.	730794.	49.01	8.204	0.67	1.00	1.08	6999.85
674.24	1345787.	1345787.	732117.	49.07	8.204	0.67	1.00	1.00	7451.08
678.00	1398833.	1398833.	760974.	50.37	0.207	0.67	1.00	1.00	7455.95
688.00	1543634.	1543634.	839747.	53.80	8.213	0.67	1.00	1.00	7561.47
694.36	1629994.	1629994.	886728.	55.28	8.213	0.67	1.00	1.00	7842.28
695.00	1638806.	1638806.	891521.	55.43	8.213	0.67	1.00	1.00	8067.81
695.01	1638771.	1638771.	891502.	55.43	8.213	0.67	1.00	1.00	8090.47
720.00	1486538.	1486538.	808687.	49.70	8.191	0.67	1.00	1.00	8090.47
766.00	1265046.	1265046.	688193.	41.90	8.164	0.67	1.00	1.00	8094.28
795.00	1167378.	1167378.	635061.	39.37	0.160	0.67	1.00	1.00	7911.12
829.00	1041725.	1041725.	566705.	35.74	8.150	0.67	1.00	1.00	7661.33
833.00	1033334.	1033334.	562140.	35.74	8.151	0.67	1.00	1.00	7422.00
850.00	998316.	998316.	543090.	35.64	8.155	0.67	1.00	1.00	7371.23
890.00	846191.	846191.	460333.	30.71	8.138	0.67	1.00	1.00	7155.46
905.00	839303.	839303.	456586.	32.63	0.152	0.67	1.00	1.00	6928.69
933.00	762845.	762845.	414993.	30.88	8.150	0.67	1.00	1.00	6649.58
955.00	720371.	720371.	391886.	30.68	8.155	0.67	1.00	1.00	6397.70
975.00	689584.	689584.	375138.	30.72	8.163	0.67	1.00	1.00	6133.25
996.00	655451.	655451.	356569.	30.12	8.167	0.67	1.00	1.00	5864.61
1007.00	622831.	622831.	338824.	28.58	8.160	0.67	1.00	1.00	5598.07
1035.00	541507.	541507.	294583.	24.87	8.144	0.67	1.00	1.00	5533.52
1072.00	441014.	441014.	239914.	20.99	8.127	0.67	1.00	1.00	5369.21
1100.00	382293.	382293.	207970.	20.43	0.130	0.67	1.00	1.00	5136.16
1119.00	348648.	348648.	189667.	20.95	8.139	0.67	1.00	1.00	4884.27
1125.00	338310.	338310.	184043.	21.17	8.142	0.67	1.00	1.00	4688.06
1140.00	327730.	327730.	178287.	23.39	8.166	0.67	1.00	1.00	4626.10
1142.00	323817.	323817.	176158.	23.69	8.169	0.67	1.00	1.00	4383.53
1158.00	296676.	296676.	161394.	26.30	8.202	0.67	1.00	1.00	4347.00
1169.00	293786.	293786.	159822.	28.81	8.240	0.67	1.00	1.00	4036.50
1175.00	311590.	311590.	169507.	30.58	8.278	0.67	1.00	1.00	3726.00
1183.00	320372.	320372.	174284.	30.80	8.308	0.67	1.00	1.00	3415.50
1192.00	324937.	324937.	176768.	29.82	8.331	0.67	1.00	1.00	3105.00
1199.00	335071.	335071.	182281.	28.52	8.356	0.67	1.00	1.00	2794.50
1202.00	354689.	354689.	192953.	27.82	8.397	0.67	1.00	1.00	2484.00
1204.00	374004.	374004.	203461.	27.08	0.451	0.67	1.00	1.00	2173.50
1205.00	382547.	382547.	206108.	26.61	8.484	0.67	1.00	1.00	1863.00
1211.00	375578.	375578.	204317.	24.03	8.481	0.67	1.00	1.00	1707.75
1221.00	361133.	361133.	196459.	19.32	0.463	0.67	1.00	1.00	1624.24
1231.00	340922.	340922.	185464.	14.18	8.473	0.67	1.00	1.00	1457.28
1240.00	321764.	321764.	175041.	9.42	0.392	0.67	1.00	1.00	1290.30
1246.00	178138.	178138.	96908.	5.27	0.345	0.67	1.00	1.00	1190.11
1252.91	-0.	-0.	-0.	0.	0.	0.	1.00	1.00	977.15

F =   1.261   LAMBDA =   0.544(5   7   0)

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	600.0	0.364	0.230	0.

C18

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	1-	1	466.50	164.80	1.00
	2-	2	695.00	440.00	1.00
	3-	3	1140.00	470.00	1.00
	4-	4	1240.00	470.00	1.00
	5-	5	1253.00	459.80	1.00

INS.IT   0   0
INS.IT   0   2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/V-Z	VERT F	SMALL F		PORE PRES
482.75	-1108.	-1108.	-597.	17.96	0.948	-18.38	1.00	1.00	0,
483.27	-867.	-867.	-467.	23.26	1.189	-24.47	1.00		588.30
525.00	74727.	74727.	46246.	10.50	0.153	1.70	1.00	1.00	607.40
526.56	79704.	79704.	42927.	10.89	0.154	1.66	1.00	1.00	2134.02
650.00	967094.	967094.	526853.	39.64	0.183	0.92	1.00	1.00	2191.02
658.00	1058203.	1058203.	569922.	41.47	0.184	0.91	1.00	1.00	6707.17
674.07	1274606.	1274606.	686472.	47.39	0.197	0.89	1.00	1.00	6999.85
674.24	1277020.	1277020.	687771.	47.45	0.198	0.89	1.00	1.00	7451.08
678.00	1329694.	1329694.	716140.	48.79	0.200	0.88	1.00	1.00	7455.95
688.00	1473630.	1473630.	793661.	52.30	0.207	0.87	1.00	1.00	7561.47
694.34	1559640.	1559640.	839984.	53.80	0.207	0.86	1.00	1.00	7842.28
695.00	1568422.	1568422.	844714.	53.95	0.207	0.86	1.00	1.00	8067.81
695.01	1568389.	1568389.	844696.	53.94	0.207	0.86	1.00	1.00	8090.47
720.00	1425343.	1425343.	767655.	48.15	0.185	0.88	1.00	1.00	8090.47
766.00	1219430.	1219430.	656755.	40.39	0.159	0.91	1.00	1.00	8094.28
795.00	1130326.	1130326.	608766.	38.01	0.154	0.92	1.00	1.00	7911.12
829.00	1014126.	1014126.	546183.	34.47	0.144	0.94	1.00	1.00	7661.33
833.00	1006691.	1006691.	542179.	34.50	0.145	0.94	1.00	1.00	7422.00
850.00	975514.	975514.	525388.	34.51	0.150	0.94	1.00	1.00	7371.23
890.00	832736.	832736.	448491.	29.57	0.133	0.97	1.00	1.00	7155.46
905.00	828193.	828193.	446045.	31.61	0.148	0.96	1.00	1.00	6928.69
933.00	756454.	756454.	407407.	29.85	0.145	0.98	1.00	1.00	6649.58
955.00	716879.	716879.	386093.	29.67	0.150	0.98	1.00	1.00	6397.70
975.00	688109.	688109.	370599.	29.71	0.157	0.98	1.00	1.00	6133.25
996.00	655605.	655605.	353093.	29.11	0.161	0.98	1.00	1.00	5864.61
1007.00	623909.	623909.	336022.	27.53	0.155	0.99	1.00	1.00	5598.07
1035.00	544612.	544612.	293315.	23.70	0.137	1.03	1.00	1.00	5533.52
1072.00	446007.	446007.	240208.	19.56	0.118	1.09	1.00	1.00	5369.21
1100.00	387809.	387809.	208864.	18.74	0.119	1.13	1.00	1.00	5136.16
1119.00	354025.	354025.	190669.	19.08	0.126	1.15	1.00	1.00	4884.27
1125.00	343567.	343567.	185036.	19.23	0.129	1.16	1.00	1.00	4688.06
1140.00	332230.	332230.	178931.	21.38	0.151	1.15	1.00	1.00	4626.01
1142.00	328245.	328245.	176785.	21.65	0.155	1.15	1.00	1.00	4383.53
1158.00	300179.	300179.	161669.	24.09	0.185	1.16	1.00	1.00	4347.00
1169.00	296033.	296033.	159436.	26.66	0.222	1.13	1.00	1.00	4036.50
1175.00	312619.	312619.	168369.	28.67	0.261	1.07	1.00	1.00	3726.00
1163.00	319799.	319799.	172236.	29.12	0.291	1.02	1.00	1.00	3415.50
1192.00	322377.	322377.	173625.	28.41	0.316	0.99	1.00	1.00	3105.00
1199.00	330633.	330633.	178071.	27.37	0.342	0.95	1.00	1.00	2794.50
1202.00	349080.	349080.	188006.	26.86	0.384	0.90	1.00	1.00	2484.00
1204.00	367442.	367442.	197895.	26.25	0.438	0.86	1.00	1.00	2173.50
1205.00	375505.	375505.	202238.	25.84	0.470	0.84	1.00	1.00	1863.00
1211.00	366624.	366624.	197454.	23.42	0.468	0.83	1.00	1.00	1707.75
1221.00	348918.	348918.	187919.	18.96	0.474	0.80	1.00	1.00	1624.26
1231.00	325382.	325382.	175243.	14.04	0.468	0.78	1.00	1.00	1457.28
1240.00	303128.	303128.	163258.	9.45	0.394	0.76	1.00	1.00	1290.30
1246.00	167951.	167951.	90454.	5.31	0.347	0.78	1.00	1.00	1190.11
1252.91	-0.	-0.	-0.	0.	0.	0.	1.00	1.00	977.15

F =   1.384 LAMBDA =   0.539(4   6   0)

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	0.	0.364	0.320	0.

SURFACE NUMBER   1 .   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT	X	Y	F(X)
	1- 1	466.50	164.80	1.00
	2- 2	695.00	440.00	1.00
	3- 3	1140.00	470.00	1.00
	4- 4	1240.00	470.00	1.00
	5- 5	1253.00	459.80	1.00

INS.IT   0   0
INS.IT   0   2

X-COORD.	E		X-FORCE	Y-YT	Y-YY/Y-Z	VERT F	SMALL F		PORE PRES
482.75	6597.	6597.	3988.	3.38	0.178	0.60	1.00	1.00	0,
483.27	7033.	7033.	4251.	3.49	0.178	0.60	1.00	1.00	818.50
525.00	86810.	86810.	52469.	12.26	0.178	0.60	1.00	1.00	845.08
526.56	91509.	91509.	55309.	12.59	0.178	0.60	1.00	1.00	2969.08
650.00	857532.	857532.	518302.	38.54	0.178	0.60	1.00	1.00	3048.38
658.00	934005.	934005.	564523.	40.22	0.178	0.60	1.00	1.00	6331.72
674.07	1127811.	1127811.	681661.	47.11	0.196	0.60	1.00	1.00	9738.92
674.24	1129970.	1129970.	682966.	47.19	0.197	0.60	1.00	1.00	10366.72
678.00	1177067.	1177067.	711432.	48.72	0.200	0.60	1.00	1.00	10373.50
688.00	1305629.	1305629.	789136.	52.68	0.209	0.60	1.00	1.00	10520.31
694.36	1378052.	1378052.	832910.	54.03	0.208	0.60	1.00	1.00	10911.00
695.00	1385442.	1385442.	837376.	54.17	0.208	0.60	1.00	1.00	11224.78
695.01	1385407.	1385407.	937355.	54.17	0.208	0.60	1.00	1.00	11256.30
720.00	1234932.	1234932.	746406.	48.38	0.186	0.60	1.00	1.00	11256.30
766.00	1041053.	1041053.	629224.	42.81	0.168	0.60	1.00	1.00	11261.61
795.00	977101.	977101.	590570.	43.43	0.176	0.60	1.00	1.00	11006.78
829.00	883258.	883258.	533851.	43.25	0.181	0.60	1.00	1.00	10659.24
833.00	881221.	881221.	532619.	43.85	0.185	0.60	1.00	1.00	10326.26
850.00	872719.	872719.	527481.	46.07	0.200	0.60	1.00	1.00	10255.62
890.00	749349.	749349.	452919.	45.24	0.203	0.60	1.00	1.00	9955.42
905.00	773992.	773993.	467810.	49.22	0.230	0.60	1.00	1.00	9639.91
933.00	725929.	725929.	438760.	50.08	0.243	0.60	1.00	1.00	9251.60
955.00	711570.	711570.	430081.	51.52	0.261	0.60	1.00	1.00	8901.14
975.00	707971.	707971.	427905.	52.41	0.277	0.60	1.00	1.00	8533.21
996.00	699684.	699684.	422897.	52.21	0.290	0.60	1.00	1.00	8159.46
1007.00	673510.	673510.	407077.	51.12	0.287	0.60	1.00	1.00	7788.62
1035.00	608255.	608255.	367636.	48.62	0.281	0.60	1.00	1.00	7698.81
1072.00	529564.	529564.	320074.	46.19	0.279	0.60	1.00	1.00	7470.20
1100.00	492651.	492651.	297764.	45.48	0.289	0.60	1.00	1.00	7145.96
1119.00	475083.	475083.	287145.	44.98	0.298	0.60	1.00	1.00	6795.51
1125.00	469685.	469685.	283883.	44.74	0.300	0.60	1.00	1.00	6522.52
1140.00	477388.	477388.	288538.	44.43	0.315	0.60	1.00	1.00	6436.31
1142.00	476119.	476119.	287772.	44.39	0.317	0.60	1.00	1.00	6098.82
1158.00	470615.	470615.	284445.	43.55	0.335	0.60	1.00	1.00	6048.00
1169.00	487978.	487978.	294940.	42.39	0.353	0.60	1.00	1.00	5616.00
1175.00	524617.	524617.	317084.	41.38	0.376	0.60	1.00	1.00	5184.00
1183.00	550522.	550522.	332742.	39.04	0.390	0.60	1.00	1.00	4752.00
1192.00	570547.	570547.	344845.	35.74	0.397	0.60	1.00	1.00	4320.00
1199.00	594573.	594573.	359366.	32.78	0.410	0.60	1.00	1.00	3888.00
1202.00	626553.	626553.	378696.	31.28	0.447	0.60	1.00	1.00	3456.00
1204.00	656605.	656605.	396859.	30.06	0.501	0.60	1.00	1.00	3024.00
1205.00	669898.	669898.	404894.	29.40	0.534	0.60	1.00	1.00	2592.00
1211.00	665214.	665214.	402063.	26.16	0.523	0.60	1.00	1.00	2376.00
1221.00	655062.	655062.	395927.	20.55	0.514	0.60	1.00	1.00	2259.84
1231.00	638723.	638723.	386051.	14.71	0.490	0.60	1.00	1.00	2027.52
1240.00	621643.	621643.	375728.	9.37	0.391	0.60	1.00	1.00	1795.20
1246.00	342680.	342680.	207120.	5.08	0.332	0.60	1.00	1.00	1655.81
1252.91	-0.	-0.	-0.	0.	0.	0.	1.00	1.00	1359.51

. F =   1.150 LAMBDA =   0.604(6   8   0)

	SOIL DATA					
NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	400.0	0.364	0.320	0.

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	1-	1	464.50	164.80	1.00
	2-	2	699.00	440.00	1.00
	3-	3	1140.00	470.00	1.00
	4-	4	1240.00	470.00	1.00
	5-	5	1253.00	459.80	1.00

INS,IT   0   0
INS,IT   0   2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
482.75	-2902.	-2902.	-1796.	8.03	8.424	-5.74	1.00	1.00	0.
483.27	-2767.	-2767.	-1712.	8.69	8.444	-6.27	1.00	1.00	818.50
525.00	54566.	54566.	33766.	8.65	8.126	1.81	1.00	1.00	845.08
526.56	58487.	58487.	36193.	9.03	8.128	1.76	1.00	1.00	2969.08
650.00	776771.	776771.	480672.	35.30	8.163	0.86	1.00	1.00	3048.38
658.00	851095.	851095.	526665.	36.95	8.164	0.85	1.00	1.00	5331.72
674.07	1040122.	1040122.	643636.	44.21	8.184	0.81	1.00	1.00	9738.92
674.24	1042230.	1042230.	644941.	44.28	8.184	0.81	1.00	1.00	10366.72
678.00	1088255.	1088255.	673422.	45.87	8.188	0.81	1.00	1.00	10373.50
688.00	1214046.	1214046.	751262.	49.95	8.198	0.79	1.00	1.00	10520.31
694.36	1285060.	1285060.	795206.	51.25	8.197	0.78	1.00	1.00	10911.00
695.00	1292313.	1292313.	799694.	51.38	8.197	0.78	1.00	1.00	11224.78
695.01	1292280.	1292280.	799673.	51.38	0.197	0.78	1.00	1.00	11256.30
720.00	1150822.	1150822.	712138.	45.06	8.173	0.81	1.00	1.00	11256.30
766.00	971753.	971753.	601329.	38.96	8.153	0.84	1.00	1.00	11261.61
795.00	915552.	915552.	566552.	39.71	8.161	0.85	1.00	1.00	11006.78
829.00	830290.	830290.	513791.	39.43	8.165	0.87	1.00	1.00	10659.24
833.00	829056.	829056.	513027.	40.09	0.169	0.87	1.00	1.00	10326.26
850.00	823741.	823741.	509738.	42.57	8.185	0.86	1.00	1.00	10255.62
890.00	708711.	708711.	438556.	41.31	8.185	0.89	1.00	1.00	9955.42
905.00	734931.	734931.	454782.	45.77	8.214	0.87	1.00	1.00	9639.91
933.00	690639.	690639.	427373.	46.58	8.226	0.88	1.00	1.00	9251.60
955.00	678294.	678294.	419734.	48.16	8.244	0.87	1.00	1.00	8901.14
975.00	675845.	675845.	418218.	49.21	8.261	0.86	1.00	1.00	8533.21
996.00	668285.	668285.	413540.	49.14	8.273	0.85	1.00	1.00	8159.46
1007.00	642675.	642675.	397692.	47.96	8.269	0.86	1.00	1.00	7788.62
1035.00	578515.	578515.	357990.	45.25	8.262	0.88	1.00	1.00	7698.81
1072.00	500422.	500422.	309665.	42.68	8.258	0.91	1.00	1.00	7470.20
1100.00	462917.	462917.	286457.	42.23	8.268	0.92	1.00	1.00	7145.96
1119.00	444403.	444403.	275000.	42.07	0.279	0.92	1.00	1.00	6795.51
1125.00	438627.	438627.	271426.	41.95	8.282	0.92	1.00	1.00	6522.52
1140.00	444809.	444809.	275252.	42.18	0.299	0.90	1.00	1.00	6436.31
1142.00	443354.	443354.	274351.	42.21	8.301	0.89	1.00	1.00	6098.82
1158.00	435977.	435977.	269786.	41.97	8.323	0.88	1.00	1.00	6048.00
1169.00	451326.	451326.	279284.	41.33	8.344	0.85	1.00	1.00	5616.00
1175.00	486203.	486203.	300866.	40.66	0.370	0.81	1.00	1.00	5184.00
1183.00	509883.	509883.	315520.	38.61	8.386	0.78	1.00	1.00	4752.00
1192.00	527257.	527257.	326271.	35.56	8.395	0.75	1.00	1.00	4320.00
1199.00	548844.	548844.	339629.	32.76	8.410	0.73	1.00	1.00	3888.00
1202.00	579310.	579310.	358482.	31.33	8.448	0.71	1.00	1.00	3456.00
1204.00	608137.	608137.	376320.	30.14	8.502	0.68	1.00	1.00	3024.00
1205.00	620822.	620822.	384170.	29.49	8.536	0.67	1.00	1.00	2592.00
1211.00	613848.	613848.	379854.	26.30	8.526	0.67	1.00	1.00	2376.00
1221.00	599785.	599785.	371152.	20.73	8.518	0.65	1.00	1.00	2259.84
1231.00	579460.	579460.	358575.	14.90	0.497	0.64	1.00	1.00	2027.52
1240.00	558704.	558704.	345731.	9.53	8.397	0.63	1.00	1.00	1795.20
1246.00	308395.	308395.	190838.	5.19	8.339	0.64	1.00	1.00	1655.81
1252.91	-0.	-0.	-0.	0.	0.	0.	1.00	1.00	1359.51

F = 1.270 LAMBDA = 0.619(7 9 0)

EXAMPLE NO. 3

Semiempirical Stability Analysis Section
After Canal Deepening

Strength	Pore Pressure	Acceleration
$c' = 0$, $\phi' = 20$ deg	$r_u = 0.32$	0.07 g
$c' = 600$ psf, $\phi' = 20$ deg	$r_u = 0.32$	0.11 g

MORGENSTERN AND PRICE METHOD OF SLOPE STABILITY ANALYSIS - DON BANKS
WITH EARTHQUAKE ANALYSIS
LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NUMBER OF POINTS   =   48

NUMBER OF LINES   =   48

NUMBER OF MATERIALS =   1

YBM =   185.00

XM =   650.00

YBP =   415.00

POINT DESCRIPTION					LINE DESCRIPTION			
POINT NO.	NO. LINES.	X-COORDINATE	Y-COORDINATE		LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	0.	150.00		1	1	2	1
2	2	240.00	150.00		2	2	3	1
3	2	290.00	160.00		3	3	4	1
4	3	466.50	165.00		4	4	5	1
5	2	658.00	170.00		5	5	6	1
6	2	688.00	179.00		6	6	7	1
7	2	720.00	181.00		7	7	8	1
8	2	766.00	190.00		8	8	9	1
9	2	795.00	200.00		9	9	10	1
10	2	829.00	210.00		10	10	11	1
11	2	850.00	220.00		11	11	12	1
12	2	890.00	230.00		12	12	13	1
13	2	905.00	240.00		13	13	14	1
14	2	933.00	250.00		14	14	15	1
15	2	955.00	260.00		15	15	16	1
16	2	975.00	270.00		16	16	17	1
17	2	996.00	280.00		17	17	18	1
18	2	1035.00	290.00		18	18	19	1
19	2	1072.00	300.00		19	19	20	1
20	2	1100.00	310.00		20	20	21	1
21	2	1125.00	320.00		21	21	22	1
22	2	1142.00	330.00		22	22	23	1
23	2	1158.00	340.00		23	23	24	1
24	2	1169.00	350.00		24	24	25	1
25	2	1175.00	360.00		25	25	26	1
26	2	1183.00	370.00		26	26	27	1
27	2	1192.00	380.00		27	27	28	1
28	2	1199.00	390.00		28	28	29	1
29	2	1202.00	400.00		29	29	30	1
30	2	1204.00	410.00		30	30	31	1
31	4	1205.00	415.00		31	31	32	1
32	2	1211.00	420.00		32	32	33	1
33	2	1221.00	430.00		33	33	34	1
34	2	1231.00	440.00		34	34	35	1
35	2	1246.00	450.00		35	35	36	1
36	2	1253.00	460.00		36	36	37	1
37	2	1360.00	460.00		37	37	38	1
38	1	1500.00	465.00		38	39	40	0
39	1	0.	185.00		39	40	41	0
40	4	525.00	237.00		40	41	42	0
41	2	670.00	250.00		41	42	43	0
42	2	833.00	276.80		42	43	44	0
43	2	1007.00	318.00		43	44	31	0
44	2	1119.00	351.20		44	31	45	0
45	1	1500.00	415.00		45	4	40	1
46	1	0.	660.00		46	40	47	1
47	3	829.00	600.00		47	46	47	1
48	1	1500.00	600.00		48	47	48	1

C24

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BXA      0.           240.000000    290.000000    466.500000    658.000000    688.000000    720.000000    766.000000
BXA      795.000000   829.000000    850.000000    890.000000    905.000000    933.000000    955.000000    975.000000
BXA      990.000000   1035.000000   1072.000000   1100.000000   1125.000000   1142.000000   1158.000000   1169.000000
BXA      1175.000000  1183.000000   1192.000000   1199.000000   1202.000000   1204.000000   1205.000000   1211.000000
BXA      1221.000000  1231.000000   1246.000000   1253.000000   1360.000000   1500.000000   0.            525.000000
BXA      674.000000   833.000000    1007.000000   1119.000000   1500.000000   0.            829.000000    1500.000000
BXA      482.750000   674.068871    650.000000
BXB      0.           240.000000    290.000000    466.500000    482.750000    525.000000    650.000000    658.000000
BXB      674.068871   678.000000    688.000000    720.000000    766.000000    795.000000    829.000000    833.000000
BXB      850.000000   890.000000    905.000000    933.000000    955.000000    975.000000    990.000000    1007.000000
BXB      1032.000000  1072.000000   1100.000000   1119.000000   1125.000000   1142.000000   1158.000000   1169.000000
BXB      1175.000000  1183.000000   1192.000000   1199.000000   1202.000000   1204.000000   1205.000000   1211.000000
BXB      1221.000000  1231.000000   1246.000000   1253.000000   1360.000000   1500.000000
X =      120.000000
BY =     150.000000    1
BY =     185.000000    49
BY =     196.885714    38
X =      265.000000
BY =     155.000000    2
BY =     185.000000    49
BY =     211.247620    38
X =      378.250000
BY =     162.500000    3
BY =     185.000000    49
BY =     222.464762    38
X =      474.625000
BY =     185.212141    4
BY =     175.000000    45
BY =     185.000000    49
BY =     232.010477    38
X =      503.875000
BY =     185.975849    4
BY =     185.000000    49
BY =     211.000000    45
BY =     234.907619    38
X =      587.500000
BY =     168.159269    4
BY =     185.000000    49
BY =     242.310457    39
BY =     311.629936    46
X =      654.000000
BY =     109.895561    4
BY =     247.960783    39
BY =     191.036186    46
BY =     413.000000    50
X =      666.034439
BY =     172.410332    5
BY =     244.983318    39
BY =     405.406258    46
BY =     413.000000    50
X =      676.034439
BY =     175.410332    5
BY =     249.832991    39
BY =     413.000000    50
BY =     417.347046    46
X =      683.000000
BY =     177.500000    5
BY =     250.864515    40
BY =     413.000000    50
BY =     425.664474    46
X =      704.000000
```

BY = 180.000000   6
BY = 254.495483   40
BY = 415.000000   50
BY = 450.740135   46
X = 743.000000
BY = 185.500000   7
BY = 261.238704   40
BY = 415.000000   50
BY = 497.309212   46
X = 780.500000
BY = 195.000000   8
BY = 267.722580   40
BY = 415.000000   50
BY = 542.087173   46
X = 812.000000
BY = 205.000000   9
BY = 276.169033   40
BY = 415.000000   50
BY = 579.700661   46
X = 831.000000
BY = 210.952381   10
BY = 276.454193   40
BY = 415.000000   50
X = 841.500000
BY = 215.952381   19
BY = 278.812645   41
BY = 415.000000   50
X = 870.000000
BY = 225.000000   11
BY = 285.560921   41
BY = 415.000000   50
X = 897.500000
BY = 234.999998   12
BY = 292.072414   41
BY = 415.000000   50
X = 919.000000
BY = 245.000000   13
BY = 297.165219   41
BY = 415.000000   50
X = 944.000000
BY = 255.000000   14
BY = 303.082760   41
BY = 415.000000   50
X = 965.000000
BY = 265.000000   15
BY = 309.055172   41
BY = 415.000000   50
X = 985.500000
BY = 275.000000   16
BY = 314.909195   41
BY = 415.000000   50
X = 1001.500000
BY = 281.410259   17
BY = 318.697700   41
BY = 415.000000   50
X = 1021.000000
BY = 286.410259   17
BY = 322.150002   42
BY = 415.000000   50
X = 1053.500000
BY = 295.000000   18
BY = 331.783928   42

BY = 415.000000   50
X = 1086.000000
BY = 305.000000   19
BY = 341.417858   42
BY = 415.000000   50
X = 1109.500000
BY = 313.799999   20
BY = 348.383930   42
BY = 415.000000   50
X = 1122.000000
BY = 318.799999   20
BY = 353.425583   43
BY = 415.000000   50
X = 1133.500000
BY = 325.000000   21
BY = 361.956978   43
BY = 415.000000   50
X = 1150.000000
BY = 335.000000   22
BY = 374.197678   43
BY = 415.000000   50
X = 1163.500000
BY = 344.999996   23
BY = 384.212791   43
BY = 415.000000   50
X = 1172.000000
BY = 354.999996   24
BY = 390.513408   43
BY = 415.000000   50
X = 1179.000000
BY = 365.000000   25
BY = 395.711628   43
BY = 415.000000   50
X = 1187.500000
BY = 375.000000   26
BY = 402.017445   43
BY = 415.000000   50
X = 1195.500000
BY = 385.000000   27
BY = 407.952328   43
BY = 415.000000   50
X = 1200.500000
BY = 394.999992   28
BY = 411.661629   43
BY = 415.000000   50
X = 1203.000000
BY = 405.000000   29
BY = 413.516281   43
BY = 415.000000   50
X = 1204.500000
BY = 412.500000   30
BY = 414.629070   43
BY = 415.000000   50
X = 1208.000000
BY = 415.000000   30
BY = 417.499996   31
X = 1216.000000
BY = 415.000000   50
BY = 425.000000   32
X = 1226.000000
BY = 415.000000   50
BY = 435.000000   33
X = 1238.500000
BY = 415.000000   50
BY = 415.000000   34
X = 1249.500000
BY = 415.000000   50
BY = 455.000004   35
X = 1306.500000
BY = 415.000000   50
BY = 460.000000   36
X = 1430.000000
BY = 415.000000   50
BY = 462.500000   37

NO. OF POINTS TO DESCRIBE FAILURE SURFACES = 5

NO. OF FAILURE SURFACE DESCRIPTION CARDS = 1

MAX. NO. OF COLUMNS TO DESCRIBE FAIL. SURF. = 5

NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES = 3

NO. OF ALTERNATE F(X) DISTRIBUTIONS = 0

FAILURE SURFACE POINTS

POINT NO.	X-COORDINATE	Y-COORDINATE	F(X)
1	466.50	164.80	1.00
	0.00	695.00	440.00
	1.00	0.00	1140.00
	470.00	1.00	0.00
	1240.00	470.00	1.00
	0.00	1253.00	459.80
	1.00		

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE				
1	1	2	3	4	5

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	0.	0.364	0.320	0.070

SURFACE NUMBER   1 /   1 (SPECIFIED)

SURFACE DEFINED BY:	POINT		X	Y	F(X)
	1-	1	460.20	164.80	1.00
	2-	2	695.00	440.00	1.00
	3-	3	1140.00	470.00	1.00
	4-	4	1240.00	470.00	1.00
	5-	5	1253.00	459.80	1.00

INS,IT   0   0
INS,IT   0   2

X-COORD,	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SHALL F		PORE PRES
482.75	7262.	7262.	4224.	4.74	0.250	0.63	1.00	1.00	0.
483.77	7741.	7741.	4507.	4.89	0.250	0.63	1.00	1.00	818.50
525.00	95554.	95554.	55577.	17.19	0.250	0.63	1.00	1.00	845.08
526.56	100727.	100727.	58505.	17.65	0.250	0.63	1.00	1.00	2969.08
650.00	943908.	943908.	549003.	54.03	0.250	0.63	1.00	1.00	3048.38
658.00	1028084.	1028084.	597962.	56.39	0.250	0.63	1.00	1.00	9331.72
674.07	1239436.	1239436.	720890.	63.79	0.266	0.63	1.00	1.00	9738.92
674.24	1241790.	1241790.	722254.	63.87	0.266	0.63	1.00	1.00	10386.72
678.00	1293151.	1293151.	752132.	65.53	0.269	0.63	1.00	1.00	10373.50
668.00	1433353.	1433353.	833679.	69.85	0.277	0.63	1.00	1.00	10920.31
694.36	1512956.	1512956.	879977.	71.71	0.276	0.63	1.00	1.00	10911.00
695.00	1521079.	1521079.	884701.	71.89	0.276	0.63	1.00	1.00	11224.78
695.01	1521052.	1521052.	884685.	71.89	0.276	0.63	1.00	1.00	11256.30
720.00	1404598.	1404598.	816953.	71.81	0.275	0.63	1.00	1.00	11256.30
766.00	1274901.	1274901.	741518.	75.72	0.297	0.63	1.00	1.00	11261.61
795.00	1251872.	1251872.	728123.	99.80	0.323	0.63	1.00	1.00	11006.78
829.00	1203900.	1203900.	700221.	83.61	0.350	0.63	1.00	1.00	10659.24
833.00	1207494.	1207494.	702260.	84.13	0.354	0.63	1.00	1.00	10326.26
850.00	1222029.	1222029.	710766.	85.86	0.373	0.63	1.00	1.00	10255.62
890.00	1144477.	1144477.	667948.	88.28	0.396	0.63	1.00	1.00	9955.42
905.00	1193090.	1193090.	693934.	88.91	0.415	0.63	1.00	1.00	9639.91
933.00	1178235.	1178235.	685294.	88.59	0.430	0.63	1.00	1.00	9251.60
955.00	1189555.	1189555.	691878.	87.44	0.443	0.63	1.00	1.00	8901.14
975.00	1204559.	1204559.	702961.	85.45	0.452	0.63	1.00	1.00	8533.21
996.00	1222815.	1222815.	711223.	82.51	0.458	0.63	1.00	1.00	8159.46
1007.00	1207487.	1207487.	702308.	80.87	0.454	0.63	1.00	1.00	7788.62
1035.00	1169272.	1169272.	680081.	76.45	0.442	0.63	1.00	1.00	7698.81
1072.00	1125135.	1125135.	654410.	70.00	0.423	0.63	1.00	1.00	7470.20
1100.00	1113726.	1113726.	647774.	64.39	0.409	0.63	1.00	1.00	7145.96
1119.00	1112871.	1112871.	647276.	60.09	0.398	0.63	1.00	1.00	6795.51
1125.00	1112608.	1112608.	647123.	58.64	0.394	0.63	1.00	1.00	6522.52
1140.00	1133317.	1133317.	659168.	54.78	0.388	0.63	1.00	1.00	6436.31
1142.00	1133685.	1133685.	659383.	54.21	0.387	0.63	1.00	1.00	6098.82
1158.00	1140886.	1140886.	663571.	49.25	0.379	0.63	1.00	1.00	6048.00
1169.00	1166948.	1166948.	678729.	45.41	0.378	0.63	1.00	1.00	5616.00
1175.00	1208770.	1208770.	703054.	43.08	0.392	0.63	1.00	1.00	5184.00
1183.00	1240437.	1240437.	721472.	39.65	0.396	0.63	1.00	1.00	4752.00
1192.00	1266141.	1266141.	736422.	35.50	0.394	0.63	1.00	1.00	4320.00
1199.00	1294415.	1294415.	752867.	32.09	0.401	0.63	1.00	1.00	3888.00
1202.00	1328672.	1328672.	772792.	30.52	0.436	0.63	1.00	1.00	3456.00
1204.00	1360379.	1360379.	791234.	29.36	0.489	0.63	1.00	1.00	3024.00
1205.00	1374403.	1374403.	799390.	28.75	0.523	0.63	1.00	1.00	2992.00
1211.00	1371416.	1371416.	797653.	25.47	0.509	0.63	1.00	1.00	2376.00
1221.00	1366367.	1366367.	702971.	19.89	0.497	0.63	1.00	1.00	2259.84
1231.00	1348072.	1348072.	784076.	14.20	0.473	0.63	1.00	1.00	2027.52
1240.00	1331262.	1331262.	774281.	9.03	0.376	0.63	1.00	1.00	1795.20
1246.00	731938.	731938.	425715.	4.83	0.316	0.63	1.00	1.00	1655.81
1252.91	-0.	-0.	0.	0.	0.	0.	1.00	1.00	1359.51

F =   0.988 LAMBDA =   0.582(8 10 0)

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	600.0	0.364	0.320	0.110

SURFACE NUMBER   1 ,   1 (SPECIFIED)

SURFACE DEFINED BY:	POINT		X	Y	F(X)
	1=	1	466.50	164.80	1.00
	2=	2	695.00	440.00	1.00
	3=	3	1140.90	470.00	1.00
	4=	4	1240.90	470.00	1.00
	5=	5	1253.90	459.80	1.00

INS,IT   0 0
INS,IT   0 2

X-COORD:	E		X-FORCE	Y=YT	Y-YT/Y-Z	VERT P	SHALL P		PORE PRES
482.75	-4280.	-4280.	-2521.	4.40	0.232	-3.89	1.00	1.00	0.
483.27	-4154.	-4154.	-2447.	4.49	0.229	-4.18	1.00	1.00	818.50
525.00	59794.	59794.	35220.	19.81	0.288	1.79	1.00	1.00	845.08
526.56	64242.	64242.	37841.	20.31	0.288	1.74	1.00	1.00	2969.08
650.00	888291.	888291.	523231.	60.31	0.279	0.87	1.00	1.00	3048.38
658.00	973832.	973832.	573617.	62.91	0.279	0.85	1.00	1.00	9331.72
674.07	1188526.	1188526.	700078.	70.72	0.295	0.82	1.00	1.00	9738.92
674.24	1190921.	1190921.	701489.	70.80	0.295	0.82	1.00	1.00	10366.72
678.00	1243206.	1243206.	732286.	92.54	0.298	0.82	1.00	1.00	10373.50
688.00	1386123.	1386123.	816469.	77.07	0.305	0.80	1.00	1.00	10920.31
694.16	1467749.	1467749.	864549.	79.09	0.304	0.80	1.00	1.00	10911.00
695.00	1476086.	1476086.	869460.	79.29	0.304	0.80	1.00	1.00	11224.78
695.01	1476065.	1476065.	869448.	79.29	0.304	0.80	1.00	1.00	11256.30
720.00	1388745.	1388745.	818013.	81.55	0.313	0.81	1.00	1.00	11256.30
766.00	1311586.	1311586.	772564.	88.80	0.349	0.82	1.00	1.00	11261.61
795.00	1320141.	1320141.	776603.	93.69	0.380	0.81	1.00	1.00	11006.78
829.00	1307317.	1307317.	770050.	97.93	0.410	0.80	1.00	1.00	10659.24
833.00	1314808.	1314808.	774462.	98.35	0.414	0.80	1.00	1.00	10326.20
850.00	1345859.	1345859.	792752.	99.56	0.432	0.79	1.00	1.00	10255.62
890.00	1309079.	1309079.	771088.	101.36	0.454	0.79	1.00	1.00	9955.42
905.00	1366497.	1366497.	804908.	100.89	0.471	0.78	1.00	1.00	9639.91
933.00	1373983.	1373983.	809318.	99.39	0.482	0.77	1.00	1.00	9251.60
955.00	1401514.	1401514.	825535.	97.10	0.492	0.76	1.00	1.00	8901.14
975.00	1434014.	1434014.	844678.	94.07	0.498	0.75	1.00	1.00	8533.21
996.00	1461155.	1461155.	860665.	90.15	0.500	0.74	1.00	1.00	8159.46
1007.00	1452192.	1452192.	855385.	88.10	0.494	0.74	1.00	1.00	7788.62
1035.00	1429440.	1429440.	841984.	82.61	0.478	0.74	1.00	1.00	7698.81
1072.00	1404032.	1404032.	827018.	74.64	0.451	0.74	1.00	1.00	7470.20
1100.00	1405199.	1405199.	827705.	67.83	0.431	0.73	1.00	1.00	7145.96
1119.00	1411886.	1411886.	831644.	62.76	0.416	0.73	1.00	1.00	6795.51
1125.00	1413827.	1413827.	832787.	61.08	0.410	0.73	1.00	1.00	6522.52
1140.00	1439485.	1439485.	847901.	56.65	0.401	0.72	1.00	1.00	6436.31
1142.00	1440466.	1440466.	848479.	55.99	0.400	0.72	1.00	1.00	6698.82
1158.00	1451881.	1451881.	855203.	50.36	0.387	0.71	1.00	1.00	6048.00
1169.00	1479984.	1479984.	871756.	46.13	0.384	0.70	1.00	1.00	5616.00
1175.00	1522432.	1522432.	896759.	43.63	0.397	0.69	1.00	1.00	5184.00
1183.00	1554356.	1554356.	915563.	40.02	0.400	0.68	1.00	1.00	4752.00
1192.00	1579677.	1579677.	930478.	35.74	0.397	0.68	1.00	1.00	4320.00
1199.00	1607113.	1607113.	946639.	32.24	0.403	0.67	1.00	1.00	3888.00
1202.00	1640759.	1640759.	966457.	30.65	0.438	0.66	1.00	1.00	3456.00
1204.00	1671896.	1671896.	984798.	29.50	0.492	0.65	1.00	1.00	3024.00
1205.00	1685581.	1685581.	992859.	28.90	0.525	0.65	1.00	1.00	2592.00
1211.00	1680434.	1680434.	989827.	25.60	0.512	0.65	1.00	1.00	2376.00
1221.00	1668242.	1668242.	982646.	19.99	0.508	0.64	1.00	1.00	2259.84
1231.00	1648089.	1648089.	970775.	14.27	0.476	0.64	1.00	1.00	2027.52
1240.90	1626355.	1626355.	957975.	9.07	0.378	0.63	1.00	1.00	1795.20
1246.00	894708.	894708.	527010.	4.84	0.317	0.64	1.00	1.00	1655.81
1252.91	-0.	-0.	-0.	0.	0.	0.	1.00	1.00	1359.51

F = 1.004 LAMBDA = 0.589(6 8 0)

EXAMPLE NO. 4

Conventional Stability Analysis Section Prior to Canal
Deepening--Total Stress Analysis Using Laboratory
Strengths with Acceleration = 0.0

C31

MORGENSTERN AND PRICE METHOD OF SLOPE STABILITY ANALYSIS = DON BANKS
WITH EARTHQUAKE ANALYSIS
LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NUMBER OF POINTS   =   95

NUMBER OF LINES   = 102

NUMBER OF MATERIALS =   4

YDM =   185.00

XM =   650.00

YDP =   415.00

POINT DESCRIPTION

POINT NO.	NO.LINES,	X-COORDINATE	Y-COORDINATE
1	1	0.	150.00
2	2	240.00	150.00
3	2	296.00	160.00
4	2	466.50	165.00
5	2	656.00	170.00
6	2	688.00	179.00
7	2	726.00	181.00
8	2	766.00	190.00
9	2	795.00	200.00
10	2	829.00	210.00
11	2	850.00	220.00
12	2	890.00	230.00
13	2	905.00	240.00
14	2	933.00	250.00
15	2	955.00	260.00
16	2	975.00	270.00
17	2	996.00	280.00
18	2	1035.00	290.00
19	2	1072.00	300.00
20	2	1100.00	310.00
21	2	1125.00	320.50
22	2	1142.00	330.00
23	2	1158.00	340.00
24	2	1169.00	350.00
25	2	1175.00	360.00
26	3	1183.00	370.00
27	3	1192.00	360.00
28	2	1199.00	390.00
29	3	1202.00	400.00
30	3	1204.00	410.00
31	4	1205.00	415.00
32	2	1211.00	420.00
33	2	1221.00	430.00
34	2	1231.00	440.00
35	2	1246.00	450.00
36	2	1253.00	470.50
37	2	1160.00	470.50
38	1	1500.00	470.50
39	2	0.	185.00
40	2	525.00	237.00
41	2	478.00	250.00
42	4	933.00	276.80
43	2	1007.00	318.00
44	2	1119.00	351.20
45	1	1500.00	415.00
46	2	350.00	208.50
47	2	369.00	210.00
48	4	482.50	234.50
49	2	570.00	253.00
50	2	476.00	257.00
51	3	1006.00	304.00
52	3	1193.50	307.00
53	1	0.	216.00
54	2	371.00	241.00
55	2	574.00	261.00
56	2	479.00	276.00
57	4	930.00	301.50
58	1	0.	240.00

POINT NO.	NO.LINES,	X-COORDINATE	Y-COORDINATE
59	2	371.00	265.00
60	2	577.00	302.00
61	2	941.00	317.50
62	4	1014.00	321.00
63	3	1135.00	325.00
64	1	0.	286.00
65	2	378.00	311.50
66	2	570.50	321.00
67	2	942.00	340.00
68	4	1137.50	365.00
69	1	0.	304.00
70	2	372.00	329.00
71	2	939.00	348.00
72	4	1153.00	376.00
73	1	0.	324.50
74	2	371.00	349.50
75	2	570.00	352.00
76	2	942.50	368.50
77	4	1181.50	396.00
78	1	0.	360.00
79	2	371.00	385.00
80	2	570.00	380.50
81	2	476.00	382.00
82	2	937.00	400.00
83	4	1199.00	410.00
84	1	0.	414.50
85	2	371.00	439.50
86	2	676.00	411.50
87	2	940.00	423.00
88	3	942.50	447.00
89	2	1057.00	413.00
90	3	1217.50	426.50
91	2	457.00	457.00
92	2	1185.00	512.00
93	1	1500.00	527.00
94	1	0.	550.00
95	1	1500.00	550.00

C32

LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	2	1
2	2	3	1
3	3	4	1
4	4	5	1
5	5	6	1
6	6	7	1
7	7	8	1
8	8	9	1
9	9	10	1
10	10	11	1
11	11	12	1
12	12	13	1
13	13	14	1
14	14	15	1
15	15	16	1
16	16	17	1
17	17	18	1
18	18	19	1
19	19	52	1
20	52	20	2
21	20	21	2
22	21	63	2
23	43	22	3
24	22	23	3
25	23	24	3
26	24	25	3
27	25	26	3
28	26	27	2
29	27	28	3
30	28	29	3
31	29	60	2
32	30	31	4
33	31	32	4
34	32	90	4
35	90	33	4
36	33	34	4
37	34	35	4
38	35	36	4
39	36	37	4
40	37	38	4
41	39	46	3
42	46	47	3
43	47	48	3
44	48	49	3
45	49	50	3
46	50	42	3
47	42	51	3
48	53	54	2
49	54	55	2
50	55	56	2
51	56	57	2
52	57	51	2
53	51	52	2
54	48	59	3
55	59	60	3
56	60	61	3
57	61	62	3
58	62	63	3
59	44	65	2
60	45	66	2
61	66	47	2
62	67	68	2
63	68	26	2
64	69	70	3
65	70	71	3
66	71	72	3
67	72	27	3
68	73	74	2
69	74	75	2
70	75	76	2
71	76	77	2
72	77	29	2
73	78	79	4
74	79	80	4
75	80	81	4
76	81	82	4
77	82	83	4
78	83	30	4
79	84	85	3
80	85	86	3
81	86	87	3
82	87	88	3
83	88	49	4
84	89	90	4
85	48	91	3
86	91	92	3
87	92	93	3
88	94	95	3
89	39	44	0
90	48	40	0
91	40	41	0
92	41	42	0
93	42	57	0
94	57	43	0
95	43	52	0
96	62	14	0
97	44	56	0
98	68	72	0
99	72	77	0
100	77	43	0
101	83	31	0
102	31	45	0

BYA	0.	240.000000	290.000000	466.500000	658.000000	688.000000	720.000000	766.000000
BYA	795.000000	829.000000	354.000000	890.000000	905.000000	933.000000	55.000000	975.000000
BYA	996.000000	1035.000000	1072.000000	1100.000000	1125.000000	1142.000000	1158.000000	1169.000000
BYA	1175.000000	1183.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000
BYA	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000	0.	525.000000
BYA	676.000000	833.000000	1307.000000	1119.000000	1500.000000	350.000000	369.000000	482.500000
BYA	570.000000	676.000000	1006.000000	1093.500000	0.	371.000000	574.000000	679.000000
BYA	930.000000	0.	371.000000	677.000000	841.000000	1014.000000	1133.000000	0.
BYA	378.000000	570.500000	842.000000	1137.500000	0.	372.000000	839.000000	1153.000000
BYA	0.	371.000000	570.000000	842.500000	1131.500000	0.	371.000000	570.000000
BYA	676.000000	837.000000	1199.000000	0.	371.000000	676.000000	840.000000	942.500000
BYA	1057.000000	1217.500000	1309.000000	1185.000000	1500.000000	0.	1000.000000	725.913040
BYA	1050.264709	1080.777771	450.000001					
BYB	0.	240.000000	290.000000	350.000000	369.000000	371.000000	372.000000	378.000000
BYB	466.500000	482.500000	525.000000	570.000000	570.500000	574.000000	50.000000	658.000000
BYB	676.000000	677.000000	678.000000	679.000000	688.000000	720.000000	725.913040	766.000000
BYB	795.000000	829.000000	833.000000	837.000000	839.000000	840.000000	41.000000	842.000000
BYB	842.500000	850.000000	890.000000	905.000000	930.000000	933.000000	42.500000	955.000000
BYB	975.000000	996.000000	1006.000000	1007.000000	1009.000000	1014.000000	1035.000000	1050.264709
BYB	1057.000000	1072.000000	1080.777771	1093.500000	1100.000000	1119.000000	1125.000000	1133.000000
BYB	1137.500000	1142.000000	1153.000000	1158.000000	1169.000000	1175.000000	1181.500000	1183.000000
BYB	1185.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.800000	1217.500000
BYB	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000		

```
X  =   170.000000
 RY =   150.000000           1
 BY =   185.000000         103
 BY =   193.057142          41
 BY =   197.310881          89
 BY =   224.086254          48
 BY =   248.086254          54
 BY =   294.095238          59
 BY =   319.064518          64
 BY =   332.586254          68
 BY =   368.086254          73
 BY =   422.586254          79
X  =   245.000000
 RY =   155.000000           2
 BY =   185.000000         103
 BY =   202.792856          41
 BY =   217.186529          89
 BY =   233.857143          48
 BY =   257.857143          54
 BY =   303.876984          59
 BY =   321.809139          64
 BY =   342.357143          68
 BY =   377.857143          73
 BY =   432.357143          79
X  =   390.000000
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BY = 415.000000   104
BY = 425.070091   84
AY = 512.738098   87
X = 1203.000000
aY = 405.000000   31
BY = 410.000000   78
BY = 413.333332   101
BY = 415.000000   104
AY = 425.280373   84
AY = 512.857147   87
X = 1204.500000

```
nY =   412.500000        32
Bv =   414.583332       101
Bv =   415.000000       104
Bv =   425.406540        84
Bv =   512.928574        87
X =   1208.000000
nY =   415.000000       104
Bv =   417.499996        33
Bv =   425.780932        84
Bv =   513.095238        87
X =   1214.250000
nY =   415.000000       104
Bv =   423.250000        34
Bv =   426.226635        84
Bv =   513.392860        87
X =   1219.250000
nY =   415.000000       104
Bv =   428.250000        35
Bv =   513.630951        87
X =   1226.000000
nY =   415.000000       104
Bv =   435.000000        36
Bv =   513.952385        87
X =   1238.500000
nY =   415.000000       104
Bv =   445.000000        37
Bv =   514.547623        87
X =   1249.500000
nY =   415.000000       104
Bv =   460.250004        38
Bv =   515.071426        87
X =   1306.500000
nY =   415.000000       144
Bv =   470.500000        39
Bv =   517.785713        87
X =   1430.000000
nY =   415.000000       104
Bv =   470.500000        40
Bv =   523.666672        87
```

LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NO. OF POINTS TO DESCRIBE FAILURE SURFACES =   7

NO. OF FAILURE SURFACE DESCRIPTION CARDS =   2

MAX. NO. OF COLUMNS TO DESCRIBE FAIL. SURF.=   4

NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES   =   0

NO. OF ALTERNATE F(X) DISTRIBUTIONS   =   0

FAILURE SURFACE POINTS

POINT NO.	X-COORDINATE	Y-COORDINATE		F(X)
1	600.00	167.00		1.00
	0.00	950.00	378.00	
	1.00	0.00	1205.00	
	409.00	1.00	0.00	
	525.00	166.00	1.00	
	0.00	975.00	463.00	
	1.00	0.00	1250.00	
	488.00	1.00	0.00	
	1285.00	459.50	1.00	

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE			
1	1	2	3	0
2	4	5	6	7

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	1000.0	0.	0.	0.
2	135.0	135.0	2000.0	0.589	0.	0.
3	135.0	135.0	3000.0	0.640	0.	0.
4	135.0	135.0	5400.0	0.575	0.	0.

SURFACE NUMBER   1 .   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	1 =	1	600.00	167.00	1.00
	2 =	2	950.00	378.00	1.00
	3 =	3	1205.00	409.00	1.00

INS.IT   n 0
INS.IT   n 2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
629.84	-89.	-89.	-36.	146.47	9.309	-436.53	1.00	1.00	0.
650.00	17887.	17887.	7197.	0.99	0.036	3.80	1.00	1.00	0.
658.00	29280.	29280.	11780.	1.89	0.059	6.71	1.00	1.00	0.
676.00	60846.	60846.	24490.	3.55	0.095	1.53	1.00	1.00	0.
677.00	62788.	62788.	25262.	3.64	0.096	1.49	1.00	1.00	0.
678.00	64750.	64750.	26051.	3.72	0.098	-.46	1.00	1.00	0.
679.00	66732.	66732.	26848.	3.81	0.099	.43	1.00	1.00	0.
688.00	85461.	85461.	34384.	4.58	0.112	.19	1.00	1.00	0.
720.00	173030.	173030.	69616.	6.94	0.119	0.84	1.00	1.00	0.
725.91	193096.	193096.	77661.	7.35	0.121	.78	1.00	1.00	0.
761.68	333844.	333844.	134316.	9.85	0.131	.56	1.00	1.00	0.
766.00	353178.	353178.	142095.	10.15	0.132	.54	1.00	1.00	0.
768.68	365363.	365363.	146997.	10.34	0.133	.53	1.00	1.00	0.
795.00	392850.	392850.	156056.	14.70	0.174	6.93	1.00	1.00	0.
801.44	400454.	400454.	161115.	15.70	0.181	1.02	1.00	1.00	0.
829.00	457528.	457528.	184079.	18.92	0.199	.22	1.00	1.00	0.
833.00	466419.	466419.	187656.	19.35	0.203	1.24	1.00	1.00	0.
837.00	475379.	475379.	191261.	19.78	0.206	1.26	1.00	1.00	0.
839.00	479885.	479885.	193073.	20.00	0.208	1.27	1.00	1.00	0.
840.00	482144.	482144.	193982.	20.10	0.208	.28	1.00	1.00	0.
841.00	484408.	484408.	194893.	20.21	0.209	.28	1.00	1.00	0.
842.00	486676.	486676.	195805.	20.31	0.210	.29	1.00	1.00	0.
842.50	487811.	487811.	196262.	20.37	0.210	1.29	1.00	1.00	0.
849.94	504844.	504844.	203115.	21.15	0.216	1.33	1.00	1.00	0.
850.00	504931.	504931.	203150.	21.15	0.216	.33	1.00	1.00	0.
890.00	576110.	576110.	231780.	26.05	0.233	1.65	1.00	1.00	0.
894.31	584703.	584703.	235245.	26.52	0.238	.68	1.00	1.00	0.
905.00	614269.	614269.	247116.	27.34	0.247	1.72	1.00	1.00	0.
910.87	630475.	630475.	253661.	27.80	0.247	1.74	1.00	1.00	0.
930.00	670416.	670416.	269730.	29.86	0.255	1.86	1.00	1.00	0.
933.00	676933.	676933.	272352.	30.17	0.256	1.88	1.00	1.00	0.
942.50	697846.	697846.	280782.	31.14	0.261	1.93	1.00	1.00	0.
948.51	711348.	711348.	286199.	31.75	0.264	1.96	1.00	1.00	0.
950.00	715922.	715922.	288030.	31.84	0.265	1.96	1.00	1.00	0.
955.00	697959.	697959.	280811.	31.24	0.263	1.99	1.00	1.00	0.
975.00	628117.	628117.	252712.	28.79	0.259	2.12	1.00	1.00	0.
996.00	558222.	558222.	224591.	26.13	0.252	2.27	1.00	1.00	0.
1006.00	525898.	525898.	211586.	24.84	0.243	2.33	1.00	1.00	0.
1007.00	522682.	522682.	210292.	24.71	0.242	.34	1.00	1.00	0.
1009.00	516258.	516258.	207707.	24.46	0.240	2.36	1.00	1.00	0.
1014.00	500230.	500230.	201267.	23.81	0.235	2.41	1.00	1.00	0.
1035.00	433820.	433820.	174540.	21.11	0.215	2.65	1.00	1.00	0.
1050.24	386382.	386382.	155454.	19.16	0.199	2.87	1.00	1.00	0.
1057.00	365691.	365691.	147129.	18.38	0.192	2.98	1.00	1.00	0.
1072.00	320139.	320139.	128802.	16.39	0.177	3.26	1.00	1.00	0.
1080.78	293868.	293868.	118232.	15.28	0.168	1.46	1.00	1.00	0.
1093.50	256399.	256399.	103158.	13.68	0.155	.80	1.00	1.00	0.
1100.00	237596.	237596.	95593.	12.87	0.149	3.94	1.00	1.00	0.
1119.00	184188.	184188.	74105.	10.49	0.130	4.50	1.00	1.00	0.
1125.00	167778.	167778.	67503.	9.75	0.123	4.75	1.00	1.00	0.
1133.00	146395.	146395.	58899.	8.77	0.117	5.09	1.00	1.00	0.
1137.50	134660.	134660.	54178.	8.21	0.112	5.29	1.00	1.00	0.
1142.00	123117.	123117.	49534.	7.66	0.107	5.51	1.00	1.00	0.
1153.00	95799.	95799.	38543.	6.32	0.096	6.20	1.00	1.00	0.
1158.00	83821.	83821.	33724.	5.72	0.090	6.64	1.00	1.00	0.
1169.00	58810.	58810.	23661.	4.47	0.081	7.68	1.00	1.00	0.
1175.00	46341.	46341.	18645.	3.70	0.082	7.81	1.00	1.00	0.
1181.50	34010.	34010.	13663.	2.89	0.076	8.46	1.00	1.00	0.
1183.00	31312.	31312.	12598.	2.70	0.074	8.66	1.00	1.00	0.
1185.00	27794.	27794.	11183.	2.45	0.071	9.23	1.00	1.00	0.
1192.00	16164.	16164.	6503.	1.54	0.056	12.75	1.00	1.00	0.
1196.45	9387.	9387.	3777.	0.97	0.045	16.30	1.00	1.00	0.
1199.00	5760.	5760.	2317.	0.63	0.035	21.36	1.00	1.00	0.
1202.00	1916.	1916.	771.	0.24	0.028	28.87	1.00	1.00	0.
1203.77	0.	0.	0.	0.	0.	0.	1.00	1.00	0.

F =   2.116 LAMBDA =   0.4021 (7 0)

SURFACE NUMBER   2 .   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	4=	4	525.00	166.00	1.00
	5=	5	975.00	463.00	1.00
	6=	6	1250.00	488.00	1.00
	7=	7	1285.00	459.50	1.00

INS.IT   n 0
INS.IT   n 2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
553.79	5355.	5355.	1891.	-0.49	-0.028	9.37	1.00	1.00	0.
570.00	24860.	24860.	8779.	2.72	0.097	3.19	1.00	1.00	0.
570.50	25653.	25653.	9059.	2.78	0.098	3.13	1.00	1.00	0.
574.00	31524.	31524.	11133.	3.24	0.106	2.74	1.00	1.00	0.
648.47	289427.	289427.	102211.	11.35	0.146	0.76	1.00	1.00	0.
650.00	297392.	297392.	105021.	11.51	0.146	0.75	1.00	1.00	0.
658.00	340758.	340758.	120339.	12.34	0.147	0.70	1.00	1.00	0.
662.09	363860.	363860.	128497.	12.77	0.150	0.66	1.00	1.00	0.
676.00	398308.	398308.	140663.	15.75	0.174	0.94	1.00	1.00	0.
677.00	400898.	400898.	141577.	15.95	0.176	0.95	1.00	1.00	0.
678.00	403503.	403503.	142497.	16.16	0.178	0.97	1.00	1.00	0.
679.00	406124.	406124.	143423.	16.36	0.179	0.98	1.00	1.00	0.
688.00	430399.	430399.	151996.	18.12	0.192	1.11	1.00	1.00	0.
693.97	447373.	447373.	157990.	19.23	0.196	1.19	1.00	1.00	0.
720.00	548975.	548975.	193870.	22.90	0.201	1.34	1.00	1.00	0.
725.91	574483.	574483.	202879.	23.65	0.203	1.36	1.00	1.00	0.
740.10	636637.	636637.	225535.	25.41	0.207	1.41	1.00	1.00	0.
766.00	748384.	748384.	264292.	29.04	0.215	1.58	1.00	1.00	0.
782.31	823442.	823442.	290799.	31.16	0.222	1.66	1.00	1.00	0.
795.00	893649.	893649.	315592.	32.46	0.225	1.68	1.00	1.00	0.
798.25	911977.	911977.	322065.	32.79	0.226	1.69	1.00	1.00	0.
829.00	1071095.	1071095.	378257.	36.64	0.234	1.82	1.00	1.00	0.
830.74	1080523.	1080523.	381587.	36.86	0.235	1.82	1.00	1.00	0.
833.00	1094546.	1094546.	386539.	37.07	0.236	1.83	1.00	1.00	0.
837.00	1119460.	1119460.	395337.	37.46	0.237	1.83	1.00	1.00	0.
839.00	1131967.	1131967.	399754.	37.66	0.238	1.84	1.00	1.00	0.
840.00	1138233.	1138233.	401967.	37.76	0.238	1.84	1.00	1.00	0.
841.00	1144506.	1144506.	404183.	37.86	0.238	1.84	1.00	1.00	0.
842.00	1150789.	1150789.	406401.	37.95	0.239	1.84	1.00	1.00	0.
842.50	1153933.	1153933.	407511.	38.00	0.239	1.84	1.00	1.00	0.
850.00	1201343.	1201343.	424254.	38.76	0.241	1.85	1.00	1.00	0.
881.40	1409902.	1409902.	497907.	41.94	0.242	1.87	1.00	1.00	0.
890.00	1458645.	1458645.	515120.	43.13	0.244	1.91	1.00	1.00	0.
902.27	1529197.	1529197.	540036.	44.82	0.253	2.00	1.00	1.00	0.
905.00	1544869.	1544869.	545571.	45.20	0.256	2.01	1.00	1.00	0.
930.00	1692825.	1692825.	597821.	48.58	0.263	2.13	1.00	1.00	0.
933.00	1711158.	1711158.	604296.	48.98	0.264	2.14	1.00	1.00	0.
942.50	1769832.	1769832.	625016.	50.22	0.268	2.18	1.00	1.00	0.
948.20	1805411.	1805411.	637591.	50.96	0.270	2.21	1.00	1.00	0.
953.19	1836890.	1836890.	648698.	51.61	0.272	2.23	1.00	1.00	0.
955.00	1849206.	1849206.	653047.	51.82	0.273	2.23	1.00	1.00	0.
975.00	1987139.	1987139.	701758.	54.14	0.281	2.29	1.00	1.00	0.
996.00	1875706.	1875706.	662406.	51.69	0.280	2.38	1.00	1.00	0.
1006.00	1823701.	1823701.	644040.	50.50	0.276	2.41	1.00	1.00	0.
1007.00	1818520.	1818520.	642211.	50.39	0.275	2.42	1.00	1.00	0.
1009.00	1808170.	1808170.	638555.	50.15	0.274	2.43	1.00	1.00	0.
1014.00	1782356.	1782356.	629439.	49.55	0.272	2.46	1.00	1.00	0.
1035.00	1674917.	1674917.	591497.	47.05	0.264	2.58	1.00	1.00	0.
1050.03	1599051.	1599051.	564705.	45.25	0.257	2.67	1.00	1.00	0.
1050.26	1597775.	1597775.	564254.	45.22	0.257	2.67	1.00	1.00	0.
1057.00	1561899.	1561899.	551585.	44.47	0.255	2.71	1.00	1.00	0.
1072.00	1482532.	1482532.	523556.	42.81	0.249	2.81	1.00	1.00	0.
1080.78	1436465.	1436465.	507288.	41.85	0.247	2.88	1.00	1.00	0.
1093.50	1370278.	1370278.	483914.	40.45	0.243	2.97	1.00	1.00	0.
1100.00	1336760.	1336760.	472084.	39.74	0.242	3.00	1.00	1.00	0.
1119.00	1240237.	1240237.	438008.	37.66	0.238	3.09	1.00	1.00	0.
1125.00	1210236.	1210236.	427395.	37.00	0.236	3.12	1.00	1.00	0.
1133.00	1170611.	1170611.	413491.	36.12	0.237	3.15	1.00	1.00	0.
1137.50	1148582.	1148582.	405622.	35.62	0.237	3.16	1.00	1.00	0.
1142.00	1126723.	1126723.	397902.	35.12	0.237	3.18	1.00	1.00	0.
1153.00	1074043.	1074043.	379313.	33.89	0.238	3.20	1.00	1.00	0.
1158.00	1050543.	1050543.	370999.	33.32	0.239	3.22	1.00	1.00	0.
1169.00	999918.	999918.	353121.	32.05	0.245	3.21	1.00	1.00	0.
1175.00	973307.	973307.	343723.	31.33	0.259	3.17	1.00	1.00	0.
1181.50	945479.	945479.	333896.	30.52	0.269	3.14	1.00	1.00	0.
1183.00	939133.	939133.	331672.	30.33	0.271	3.13	1.00	1.00	0.
1185.00	930857.	930857.	328732.	30.08	0.274	3.14	1.00	1.00	0.
1192.00	902297.	902297.	318646.	29.16	0.284	3.14	1.00	1.00	0.
1199.00	874784.	874784.	308930.	28.22	0.302	3.09	1.00	1.00	0.
1202.00	863512.	863512.	304949.	27.79	0.332	3.00	1.00	1.00	0.
1204.00	856351.	856351.	302420.	27.50	0.373	2.95	1.00	1.00	0.
1205.00	852914.	852914.	301203.	27.35	0.397	2.86	1.00	1.00	0.
1211.00	831758.	831758.	293746.	26.39	0.409	2.81	1.00	1.00	0.
1217.50	806590.	806590.	284847.	25.23	0.431	2.74	1.00	1.00	0.
1221.00	792019.	792019.	279702.	24.56	0.444	2.70	1.00	1.00	0.
1231.00	746525.	746525.	263635.	22.51	0.486	2.58	1.00	1.00	0.
1246.00	679435.	679435.	239943.	19.45	0.517	2.48	1.00	1.00	0.
1250.00	652878.	652878.	230564.	18.45	0.571	2.38	1.00	1.00	0.
1253.00	564234.	564234.	199259.	16.98	0.664	2.32	1.00	1.00	0.
1284.39	-0.	-0.	-0.	0.	0.	0.	1.00	1.00	0.

F = 2.595 LAMEDA =   0.353(7 8 0)
STOP AT LINE   5......

Conventional Stability Analysis Section After Canal
Deepening-Total Stress Analysis Using Laboratory
Strengths With Acceleration = 0.0

NUMBER OF POINTS   =   95
NUMBER OF LINES   = 102
NUMBER OF MATERIALS =   4

YDM =   185.00
XM =   650.00
YDP =   415.00

POINT DESCRIPTION

POINT NO.	NO.LINES	X-COORDINATE	Y-COORDINATE
1	1	0.	150.00
2	2	240.00	150.00
3	2	290.00	160.00
4	2	466.50	165.00
5	2	650.00	170.00
6	2	688.00	179.00
7	2	720.00	181.00
8	2	766.00	190.00
9	2	795.00	200.00
10	2	820.00	210.00
11	2	850.00	220.00
12	2	890.00	230.00
13	2	905.00	240.00
14	2	933.00	250.00
15	2	955.00	260.00
16	2	975.00	270.00
17	2	996.00	280.00
18	2	1035.00	290.00
19	2	1072.00	300.00
20	2	1100.00	310.00
21	2	1129.00	320.00
22	2	1142.00	330.00
23	2	1158.00	340.00
24	2	1169.00	350.00
25	2	1175.00	360.00
26	3	1183.00	370.00
27	3	1192.00	380.00
28	2	1199.00	390.00
29	3	1202.00	400.00
30	3	1204.00	410.00
31	4	1205.00	415.00
32	2	1211.00	420.00
33	2	1221.00	430.00
34	2	1231.00	440.00
35	2	1246.00	450.00
36	2	1253.00	470.50
37	2	1366.00	470.50
38	1	1500.00	470.50
39	2	0.	185.00
40	2	525.00	237.00
41	2	678.00	250.00
42	4	833.00	276.80
43	2	1007.00	318.00
44	2	1119.00	351.20
45	1	1500.00	415.00
46	2	350.00	208.50
47	2	369.00	210.00
48	4	492.50	224.50
49	2	672.00	259.00
50	2	272.00	259.00
51	3	1006.00	304.00
52	3	1093.50	307.00
53	1	0.	216.00
54	2	371.00	241.00
55	2	574.00	261.00
56	2	679.00	276.00
57	4	930.00	301.50
58	1	0.	240.00
59	2	371.00	265.00
60	2	677.00	302.00
61	2	841.00	317.50
62	4	1014.00	321.00
63	3	1133.00	325.00
64	1	0.	246.00
65	2	378.80	321.50
66	2	570.50	321.00
67	2	842.00	340.00
68	4	1137.50	365.00
69	1	0.	304.00
70	2	372.00	329.00
71	2	839.00	348.00
72	4	1153.00	376.00
73	1	0.	324.50
74	2	371.00	349.50
75	2	570.00	352.00
76	2	842.50	368.50
77	4	1181.50	396.00
78	1	0.	360.00
79	2	371.00	385.00
80	2	570.00	380.50
81	2	676.00	382.00
82	2	837.00	400.00
83	4	1199.00	430.00
84	1	0.	414.50
85	2	371.00	439.50
86	2	676.00	431.50
87	2	840.00	423.00
88	3	942.50	447.00
89	2	1057.00	433.00
90	3	1217.50	426.50
91	2	1009.00	457.00
92	2	1185.00	512.00
93	1	1500.00	527.00
94	1	0.	550.00
95	1	1500.00	550.00

LINE DESCRIPTION

LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	2	1
2	2	3	1
3	3	4	1
4	4	5	1
5	5	6	1
6	6	7	1
7	7	8	1
8	8	9	1
9	9	10	1
10	10	11	1
11	11	12	1
12	12	13	1
13	13	14	1
14	14	15	1
15	15	16	1
16	16	17	1
17	17	18	1
18	18	19	1
19	19	52	1
20	52	20	2
21	20	21	2
22	21	63	2
23	63	22	3
24	22	23	3
25	23	24	3
26	24	25	3
27	25	26	3
28	26	27	2
29	27	28	3
30	28	29	3
31	29	30	2
32	30	31	4
33	31	32	4
34	32	90	4
35	90	33	4
36	33	34	4
37	34	35	4
38	35	36	4
39	36	37	4
40	37	38	4
41	39	46	3
42	46	47	3
43	47	48	3
44	48	49	3
45	49	50	3
46	50	42	3
47	42	51	3
48	53	54	2
49	54	55	2
50	55	56	2
51	56	57	2
52	57	51	2
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62	67	68	2
63	68	26	2
64	69	70	3
65	70	71	3
66	71	72	3
67	72	27	3
68	73	74	2
69	74	75	2
70	75	76	2
71	76	77	2
72	77	29	2
73	78	79	4
74	79	80	4
75	80	81	4
76	81	82	4
77	82	83	4
78	83	30	4
79	84	85	3
80	85	86	3
81	86	87	3
82	87	88	3
83	88	89	4
84	89	90	4
85	88	91	3
86	91	92	3
87	92	93	3
88	94	95	3
89	39	48	0
90	48	40	0
91	40	41	0
92	41	42	0
93	42	57	0
94	57	43	0
95	43	62	0
96	62	44	0
97	44	68	0
98	68	72	0
99	72	77	0
100	77	83	0
101	83	31	0
102	31	45	0

BVA	0.	240.000000	290.000000	466.500000	658.000000	688.000000	720.000000	766.000000
BVA	795.000000	829.000000	850.000000	890.000000	905.000000	933.000000	955.000000	975.000000
BVA	996.000000	1035.000000	1072.000000	1100.000000	1125.000000	1142.000000	1158.000000	1169.000000
BVA	1175.000000	1183.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000
BVA	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000	0.	525.000000
BVA	678.000000	833.000000	1007.000000	1119.000000	1500.000000	350.000000	369.000000	482.500000
BVA	570.000000	676.000000	1004.000000	1093.500000	0.	371.000000	574.000000	679.000000
BVA	930.000000	0.	371.000000	677.000000	841.000000	1014.000000	1133.000000	0.
BVA	378.000000	570.500000	842.000000	1137.500000	0.	372.000000	839.000000	1153.000000
BVA	0.	371.000000	570.000000	842.500000	1181.500000	0.	371.000000	570.000000
BVA	676.000000	837.000000	1199.000000	0.	371.000000	676.000000	840.000000	942.500000
BVA	1057.000000	1217.500000	1009.000000	1185.000000	1500.000000	0.	1500.000000	725.913040
BVA	1050.264709	1080.777771	450.000000					
BVB	0.	240.000000	290.000000	350.000000	369.000000	371.000000	372.000000	378.000000
BVB	466.500000	482.500000	525.000000	570.000000	570.500000	574.000000	658.000000	658.000000
BVB	676.000000	677.000000	678.000000	679.000000	688.000000	720.000000	725.913040	766.000000
BVB	795.000000	829.000000	833.000000	837.000000	839.000000	840.000000	841.000000	842.000000
BVB	842.500000	850.000000	890.000000	905.000000	930.000000	933.000000	942.500000	955.000000
BVB	975.000000	996.000000	1004.000000	1007.000000	1009.000000	1014.000000	1035.000000	1050.264709
BVB	1057.000000	1072.000000	1080.777771	1093.500000	1100.000000	1119.000000	1125.000000	1133.000000
BVB	1137.500000	1142.000000	1153.000000	1158.000000	1169.000000	1175.000000	1181.500000	1183.000000
BVB	1185.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000	1217.500000
BVB	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000		

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X  =   120.000000
dY =   150.000000        1
BV =   185.000000      103
BV =   193.057142       41
BV =   197.310881       89
BV =   224.086254       48
BV =   248.086254       54
BV =   294.095238       59
BV =   312.064518       64
BV =   332.586254       68
BV =   368.086254       73
BV =   422.586254       79
X  =   265.000000
dY =   155.000000        2
BV =   185.000000      103
BV =   202.792856       41
BV =   212.186529       89
BV =   233.857143       48
BV =   257.857143       54
BV =   303.876984       59
BV =   321.809139       64
BV =   342.357143       68
BV =   377.857143       73
BV =   432.357143       79
X  =   320.000000
dY =   160.849857        3
BV =   185.000000      103
BV =   206.485714       41
BV =   217.829016       89
BV =   237.563343       48
BV =   261.563343       54
BV =   307.587303       59
BV =   325.505375       64
BV =   346.063343       68
BV =   381.563343       73
BV =   436.063343       79
X  =   359.500000
dY =   161.968838        3
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BȲ =     221.881348    89          BȲ =     277.514706    58
BȲ =     240.225067    48          BȲ =     316.262337    60
BȲ =     264.225067    54          BȲ =     333.170235    65
BȲ =     310.251984    59          BȲ =     350.800251    69
BȲ =     328.159946    64          BȲ =     382.659546    74
BȲ =     348.725067    68          BȲ =     429.998360    80
BȲ =     384.225067    73      X =     503.750000
BȲ =     438.725067    79          ĀY =    165.972586       4
X =     370.000000                 BȲ =     185.000000   103
ĀY =    162.266289       3         BȲ =     235.750000    90
BȲ =     185.000000   103          BȲ =     238.992857    44
BȲ =     210.215858    43          BȲ =     254.078819    49
BȲ =     222.958550    89          BȲ =     281.051472    55
BȲ =     240.932615    48          BȲ =     317.705845    60
BȲ =     264.932613    54          BȲ =     334.360279    65
BȲ =     310.960316    59          BȲ =     351.167713    69
BȲ =     328.865593    64          BȲ =     381.998116    74
BȲ =     349.432613    68          BȲ =     427.313114    80
BȲ =     384.932613    73      X =     547.500000
BȲ =     439.432613    79          ĀY =    167.114882       4
X =     371.500000                 BȲ =     185.000000   103
ĀY =    162.308783       3         BȲ =     238.911764    91
BȲ =     185.000000   103          BȲ =     248.242857    44
BȲ =     210.539646    43          BȲ =     258.389164    49
BȲ =     223.112434    89          BȲ =     286.341503    55
BȲ =     241.049261    49          BȲ =     319.864937    60
BȲ =     265.060455    55          BȲ =     336.140259    65
BȲ =     311.061508    59          BȲ =     351.717335    69
BȲ =     328.966396    64          BȲ =     381.008793    74
BȲ =     349.506279    69          BȲ =     423.296722    80
BȲ =     384.988693    74      X =     570.250000
BȲ =     439.454098    80          ĀY =    167.708878       4
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ĀY =    162.407932       3         BȲ =     240.844770    91
BȲ =     185.000000   103          BȲ =     253.009434    45
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BȲ =     329.122055    65          BȲ =     380.503540    75
BȲ =     349.550251    69          BȲ =     421.208199    80
BȲ =     384.909546    74      X =     572.250000
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X =     422.250000                 BȲ =     185.000000   103
ĀY =    163.746458       3         BȲ =     241.014706    91
BȲ =     185.000000   103          BȲ =     253.684906    45
BȲ =     221.494493    43          BȲ =     260.827587    49
BȲ =     228.318913    89          BȲ =     289.334148    55
BȲ =     246.049261    49          BȲ =     321.122471    61
BȲ =     271.196896    55          BȲ =     337.147217    65
BȲ =     313.683765    60          BȲ =     352.136242    70
BȲ =     331.044434    65          BȲ =     380.531841    75
BȲ =     350.143845    69          BȲ =     421.024590    80
BȲ =     383.841080    74      X =     612.000000
BȲ =     434.795082    80          ĀY =    168.798956       4
X =     474.500000                 BȲ =     185.000000   103
ĀY =    165.208878       4         BȲ =     244.392157    91
BȲ =     185.000000   103          BȲ =     254.584906    45
BȲ =     232.773127    43          BȲ =     266.428574    50
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C49

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BỸ =   323.904236    61
BỸ =   338.764454    65
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X =    654.000000
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BỸ =   247.960783    91
BỸ =   256.169811    45
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BỸ =   299.218952    55
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BỸ =   415.000000   104
X =    683.500000
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BỸ =   260.531208    46
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BỸ =   360.113762    70
BỸ =   385.130436    76
BỸ =   413.463413    81
BỸ =   415.000000   104
X =    722.956520
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BỸ =   257.773129    92
BỸ =   262.921906    46
BỸ =   280.465702    51
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BỸ =   331.669151    61
BỸ =   343.278744    65
BỸ =   361.261589    70
BỸ =   387.249798    76
BỸ =   414.792683    81
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X =    745.956520
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BỸ =   265.822540    46
BỸ =   282.802357    51
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BỸ =   389.821224    76
BỸ =   415.000000   104
BỸ =   416.405487    81
X =    780.500000
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BỸ =   267.722580    92
BỸ =   270.178978    46
BỸ =   286.311752    51
BỸ =   311.782013    56
BỸ =   335.696133    61
BỸ =   345.619915    65
BỸ =   364.745872    70
BỸ =   393.683228    76
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BȲ =  295.224228    93        BȲ =  309.000000    94
BȲ =  298.198208    51        BȲ =  320.008671    57
BȲ =  318.643063    57        BȲ =  350.406090    62
BȲ =  344.695431    62        BȲ =  359.235668    66
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BȲ =  372.961651    71        BȲ =  403.535912    77
BȲ =  401.671268    77        BȲ =  415.000000   104
BȲ =  415.000000   104        BȲ =  440.318775    83
BȲ =  436.463417    82        BȲ =  450.383457    85
X =   917.500000               X =   985.500000
ÂY =  244.464285    13        ÂY =  275.000000    16
BȲ =  290.085548    47        BȲ =  300.776878    47
BȲ =  298.317009    93        BȲ =  303.325657    52
BȲ =  300.230080    51        BȲ =  313.392857    94
BȲ =  319.047688    57        BȲ =  320.423412    57
BȲ =  346.387478    62        BȲ =  352.140438    62
BȲ =  355.000000    66        BȲ =  361.063694    66
BȲ =  374.584072    71        BȲ =  380.100296    71
BȲ =  402.223755    77        BȲ =  404.102211    77
BȲ =  415.000000   104        BȲ =  415.000000   104
BȲ =  441.146343    82        BȲ =  434.231441    83
X =   931.500000               BȲ =  453.466164    85
ÂY =  249.464285    13        X =  1001.000000
BȲ =  292.286705    47        ÂY =  281.282051    17
BȲ =  301.549343    52        BȲ =  303.213871    47
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BȲ =  319.330925    57        BȲ =  316.714287    94
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BȲ =  375.719765    71        BȲ =  362.445858    66
BȲ =  402.610497    77        BȲ =  381.357670    71
BȲ =  415.000000   104        BȲ =  404.530384    77
BȲ =  444.424393    82        BȲ =  415.000000   104
X =   937.750000               BȲ =  429.628819    83
ÂY =  252.159090    14        BȲ =  455.796993    85
BȲ =  293.269363    47        X =  1006.500000
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BȲ =  319.457371    57        BȲ =  317.892857    94
BȲ =  348.100677    62        BȲ =  320.848267    57
BȲ =  356.805733    66        BȲ =  353.917088    62
BȲ =  376.226768    71        BȲ =  362.936306    66
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BȲ =  415.000000   104        BȲ =  404.682320    77
BȲ =  445.887806    82        BȲ =  415.000000   104
X =   948.750000               BȲ =  427.995632    83
ÂY =  257.159092    14        BȲ =  456.624098    85
BȲ =  294.998844    47        X =  1008.000000
BȲ =  302.116776    52        ÂY =  283.076923    17
BȲ =  305.517857    94        BȲ =  304.068573    53
BȲ =  319.679913    57        BȲ =  318.428570    95
BȲ =  349.031303    62        BȲ =  320.878613    57
BȲ =  357.786621    66        BȲ =  354.043991    62
BȲ =  377.119102    71        BȲ =  363.070041    66
BȲ =  403.087017    77        BȲ =  381.925518    71
BȲ =  415.000000   104        BȲ =  404.723755    77
BȲ =  445.144104    83        BȲ =  415.000000   104
BȲ =  447.939850    85        BȲ =  427.550217    83
X =   965.000000               BȲ =  456.849625    85
ÂY =  265.000000    15        X =  1011.500000
BȲ =  297.553757    47        ÂY =  283.974358    17
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Bỹ =    320.949421    57
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Bỹ =    363.382164    66
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Bỹ =    457.781250    86
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ÂY =    287.307693    17
Bỹ =    304.634285    53
Bỹ =    321.352940    58
Bỹ =    324.020000    96
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Bỹ =    305.255966    53
Bỹ =    321.962433    58
Bỹ =    329.235210    96
Bỹ =    356.973972    62
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Bỹ =    467.510113    86
X =  1053.632355
ÂY =    295.035770    18
Bỹ =    305.633110    53
Bỹ =    322.332180    58
Bỹ =    332.399021    96
Bỹ =    357.904598    62
Bỹ =    367.139191    66
Bỹ =    385.627254    71
Bỹ =    405.984318    77
Bỹ =    414.000000    83
Bỹ =    415.000000   104
Bỹ =    470.947613    86
X =  1064.500000
ÂY =    297.972973    18
Bỹ =    306.005714    53
Bỹ =    322.697479    58
Bỹ =    335.524761    96
Bỹ =    358.824028    62
Bỹ =    368.108280    66
Bỹ =    386.508850    71
Bỹ =    406.284531    77
Bỹ =    413.630840    84
Bỹ =    415.000000   104
Bỹ =    474.343750    86
X =  1076.388885
ÂY =    301.428940    19
Bỹ =    306.413334    53
Bỹ =    323.097103    58

Bỹ =    338.944233    94
Bỹ =    359.829853    62
Bỹ =    369.168434    66
Bỹ =    387.473286    71
Bỹ =    406.612953    77
Bỹ =    414.630840    84
Bỹ =    415.000000   104
Bỹ =    478.059029    86
X =  1087.138885
ÂY =    304.928940    19
Bỹ =    306.781906    53
Bỹ =    323.458490    50
Bỹ =    342.036137    96
Bỹ =    360.739330    62
Bỹ =    370.127033    66
Bỹ =    388.345337    71
Bỹ =    406.909912    77
Bỹ =    415.000000   104
Bỹ =    415.535046    84
Bỹ =    481.418404    86
X =  1096.750000
ÂY =    308.500000    20
Bỹ =    323.781513    58
Bỹ =    344.800476    96
Bỹ =    361.552452    62
Bỹ =    370.984074    66
Bỹ =    389.125000    71
Bỹ =    407.175415    77
Bỹ =    415.000000   104
Bỹ =    416.343456    84
Bỹ =    484.421875    86
X =  1109.500000
ÂY =    313.799999    21
Bỹ =    324.210083    58
Bỹ =    348.467621    96
Bỹ =    362.631134    62
Bỹ =    372.121017    66
Bỹ =    390.159294    71
Bỹ =    407.527622    77
Bỹ =    415.000000   104
Bỹ =    417.415886    84
Bỹ =    488.406250    86
X =  1122.000000
ÂY =    318.799999    21
Bỹ =    324.630253    58
Bỹ =    353.437840    97
Bỹ =    363.688663    62
Bỹ =    373.235668    66
Bỹ =    391.173306    71
Bỹ =    407.872929    77
Bỹ =    415.000000   104
Bỹ =    418.467289    84
Bỹ =    492.312500    86
X =  1199.000000
ÂY =    322.500000    22
Bỹ =    324.865547    58
Bỹ =    358.659462    97
Bỹ =    364.280880    62
Bỹ =    373.859871    66
Bỹ =    391.741150    71
Bỹ =    408.066296    77
Bỹ =    415.000000   104
```

BỸ = 419.988878   84
BỸ = 494.588888   86
X = 1135.250000
 ÂY =   326.250000   23
BỸ =   363.321621   97
BỸ =   364.809643   62
BỸ =   374.417194   66
BỸ =   392.248158   71
BỸ =   408.238949   77
BỸ =   415.000000   104
BỸ =   419.581776   84
BỸ =   496.453125   86
X = 1139.750000
 ÂY =   328.750000   23
BỸ =   365.247253   63
BỸ =   366.596775   98
BỸ =   374.818470   66
BỸ =   392.613201   71
BỸ =   408.363258   77
BỸ =   415.000000   104
BỸ =   419.960278   84
BỸ =   497.859375   86
X = 1147.500000
 ÂY =   333.437500   24
BỸ =   366.098900   63
BỸ =   372.096775   98
BỸ =   375.509552   66
BỸ =   393.241800   71
BỸ =   408.577347   77
BỸ =   415.000000   104
BỸ =   420.612148   84
BỸ =   500.281250   86
X = 1155.500000
 ÂY =   338.437500   24
BỸ =   366.978024   63
BỸ =   376.256409   67
BỸ =   377.754387   99
BỸ =   393.890854   71
BỸ =   408.798340   77
BỸ =   415.000000   104
BỸ =   421.285046   84
BỸ =   502.781250   86
X = 1163.500000
 ÂY =   344.999996   25
BỸ =   367.857143   63
BỸ =   377.076920   67
BỸ =   383.368423   99
BỸ =   394.539822   71
BỸ =   409.019337   77
BỸ =   415.000000   104
BỸ =   421.957943   84
BỸ =   505.281250   86
X = 1172.000000
 ÂY =   354.999996   26
BỸ =   368.791210   63
BỸ =   377.948715   67
BỸ =   389.333336   99
BỸ =   395.229351   71
BỸ =   409.254143   77
BỸ =   415.000000   104
BỸ =   422.672897   84
BỸ =   507.937500   86

X = 1178.250000
 ÂY =   364.062500   27
BỸ =   369.478024   63
BỸ =   378.589741   67
BỸ =   393.719299   99
BỸ =   395.736359   71
BỸ =   409.426796   77
BỸ =   415.000000   104
BỸ =   423.198597   84
BỸ =   509.890625   86
X = 1182.250000
 ÂY =   369.062500   27
BỸ =   369.917583   63
BỸ =   379.000000   67
BỸ =   396.146343   72
BỸ =   396.599998   100
BỸ =   409.537292   77
BỸ =   415.000000   104
BỸ =   423.535046   84
BỸ =   511.140625   86
X = 1184.000000
 ÂY =   371.111115   28
BỸ =   379.179485   67
BỸ =   396.487804   72
BỸ =   398.000000   100
BỸ =   409.585636   77
BỸ =   415.000000   104
BỸ =   423.682243   84
BỸ =   511.687500   86
X = 1188.500000
 ÂY =   376.111111   28
BỸ =   379.641026   67
BỸ =   397.365856   72
BỸ =   401.599998   100
BỸ =   409.709946   77
BỸ =   415.000000   104
BỸ =   424.060745   84
BỸ =   512.166672   87
X = 1195.500000
 ÂY =   385.000000   29
BỸ =   398.731709   72
BỸ =   407.200001   100
BỸ =   409.903313   77
BỸ =   415.000000   104
BỸ =   424.649532   84
BỸ =   512.500000   87
X = 1200.500000
 ÂY =   394.999992   30
BỸ =   399.707317   72
BỸ =   410.000000   78
BỸ =   411.249996   101
BỸ =   415.000000   104
BỸ =   425.070091   84
BỸ =   512.738098   87
X = 1203.000000
 ÂY =   405.000000   31
BỸ =   410.000000   78
BỸ =   413.333332   101
BỸ =   415.000000   104
BỸ =   425.280373   84
BỸ =   512.857147   87
X = 1204.500000

C54

```
ẦY =    412.500000        32
BῩ =    414.583332       101
BῩ =    415.000000       104
BῩ =    425.406540        84
BῩ =    512.928574        87
X  =   1208.000000
ẦY =    415.000000       104
BῩ =    417.499996        33
BῩ =    425.700932        84
BῩ =    513.095238        87
X  =   1214.250000
ẦY =    415.000000       104
BῩ =    423.250000        34
BῩ =    426.226635        84
BῩ =    513.392860        87
X  =   1219.250000
ẦY =    415.000000       104
BῩ =    428.250000        35
BῩ =    513.630951        87
X  =   1226.000000
ẦY =    415.000000       104
BῩ =    435.000000        36
BῩ =    513.952385        87
X  =   1238.500000
ẦY =    415.000000       104
BῩ =    445.000000        37
BῩ =    514.547623        87
X  =   1249.500000
ẦY =    415.000000       104
BῩ =    460.250004        38
BῩ =    515.071426        87
X  =   1306.500000
ẦY =    415.000000       104
BῩ =    470.500000        39
BῩ =    517.785713        87
X  =   1430.000000
ẦY =    415.000000       104
BῩ =    470.500000        40
BῩ =    523.666672        87
```

C55

LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NO. OF POINTS TO DESCRIBE FAILURE SURFACES =	7
NO. OF FAILURE SURFACE DESCRIPTION CARDS =	2
MAX. NO. OF COLUMNS TO DESCRIBE FAIL. SURF. =	4
NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES =	3
NO. OF ALTERNATE F(X) DISTRIBUTIONS =	0

FAILURE SURFACE POINTS

POINT NO.	X-COORDINATE	Y-COORDINATE	F(X)
1	600.00	167.00	1.00
	0.00	950.00	378.00
	1.00	0.00	1205.00
	409.00	1.00	0.00
	525.00	166.00	1.00
	0.00	975.00	463.00
	1.00	0.00	1250.00
	488.00	1.00	0.00
	1285.00	466.50	1.00

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE			
1	1	2	3	4
2	4	5	6	7

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	1000.0	0.	0.	0.
2	135.0	135.0	2000.0	0.589	0.	0.
3	135.0	135.0	3000.0	0.640	0.	0.
4	135.0	135.0	5400.0	0.575	0.	0.

C56

```
SURFACE NUMBER   1 .   1 (SPECIFIED)

SURFACE DEFINED BY#   POINT         X            Y          F(X)
                      1=  1       600.00       167.00       1.00
                      2=  2       950.00       378.00       1.00
                      3=  3      1205.00       409.00       1.00
INS.IT   0   0
INS.IT   0   2
```

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VEPT F	SMALL F		POFE PRES
629.86	-39.	-89.	-36.	146.47	9.303	-438.53	1.00	1.00	0.
650.00	17837.	17837.	7197.	0.99	0.036	3.80	1.00	1.00	0.
658.00	29230.	29230.	11780.	1.89	0.059	2.71	1.00	1.00	0.
676.00	60846.	60846.	24480.	3.55	0.095	1.53	1.00	1.00	0.
677.00	62738.	62738.	25262.	3.64	0.096	1.49	1.00	1.00	0.
678.00	64750.	64750.	26051.	3.72	0.098	1.46	1.00	1.00	0.
679.00	66732.	66732.	26848.	3.81	0.099	1.43	1.00	1.00	0.
688.00	85461.	85461.	34384.	4.58	0.112	1.19	1.00	1.00	0.
720.00	173030.	173030.	69616.	6.94	0.119	0.84	1.00	1.00	0.
725.91	193026.	193026.	77661.	7.35	0.121	0.78	1.00	1.00	0.
761.68	333844.	333844.	134316.	9.85	0.131	0.56	1.00	1.00	0.
766.00	353178.	353178.	142095.	10.15	0.132	0.54	1.00	1.00	0.
768.68	365363.	365363.	146997.	10.34	0.133	0.53	1.00	1.00	0.
795.00	392850.	392850.	158056.	14.70	0.174	0.93	1.00	1.00	0.
841.44	400454.	400454.	161115.	15.70	0.181	1.02	1.00	1.00	0.
829.00	457528.	457528.	184078.	18.92	0.199	1.22	1.00	1.00	0.
833.00	466419.	466419.	187656.	19.35	0.203	1.24	1.00	1.00	0.
837.00	475379.	475379.	191261.	19.78	0.206	1.26	1.00	1.00	0.
839.00	479835.	479835.	193073.	20.00	0.208	1.27	1.00	1.00	0.
840.00	482144.	482144.	193982.	20.10	0.208	1.28	1.00	1.00	0.
841.00	484408.	484408.	194893.	20.21	0.209	1.28	1.00	1.00	0.
842.00	486676.	486676.	195805.	20.31	0.210	1.29	1.00	1.00	0.
842.50	487811.	487811.	196262.	20.37	0.210	1.29	1.00	1.00	0.
849.94	504844.	504844.	203115.	21.15	0.216	1.33	1.00	1.00	0.
850.00	504931.	504931.	203150.	21.15	0.216	1.33	1.00	1.00	0.
890.00	576110.	576110.	231788.	26.05	0.233	1.65	1.00	1.00	0.
894.31	584703.	584703.	235245.	26.52	0.238	1.68	1.00	1.00	0.
905.00	614209.	614209.	247116.	27.34	0.247	1.72	1.00	1.00	0.
910.87	630475.	630475.	253661.	27.80	0.247	1.74	1.00	1.00	0.
930.00	670416.	670416.	269730.	29.86	0.255	1.86	1.00	1.00	0.
933.00	676933.	676933.	272352.	30.17	0.256	1.88	1.00	1.00	0.
942.50	697886.	697886.	280782.	31.14	0.261	1.93	1.00	1.00	0.
948.51	711348.	711348.	286199.	31.75	0.264	1.96	1.00	1.00	0.
950.00	715922.	715922.	288039.	31.84	0.265	1.96	1.00	1.00	0.
955.00	697959.	697959.	280811.	31.24	0.263	1.99	1.00	1.00	0.
975.00	628117.	628117.	252712.	28.79	0.259	2.12	1.00	1.00	0.
996.00	558222.	558222.	224591.	26.13	0.252	2.27	1.00	1.00	0.
1006.00	525898.	525898.	211586.	24.84	0.243	2.33	1.00	1.00	0.
1007.00	522682.	522682.	210292.	24.71	0.242	2.34	1.00	1.00	0.
1009.00	516258.	516258.	207707.	24.46	0.240	2.36	1.00	1.00	0.
1014.00	500250.	500250.	201267.	23.81	0.235	2.41	1.00	1.00	0.
1035.00	433820.	433820.	174540.	21.11	0.215	2.65	1.00	1.00	0.
1050.26	386342.	386342.	155454.	19.14	0.199	2.87	1.00	1.00	0.
1057.00	365691.	365691.	147129.	18.30	0.192	2.98	1.00	1.00	0.
1072.00	320139.	320139.	128802.	16.39	0.177	3.26	1.00	1.00	0.
1080.78	293868.	293868.	118232.	15.28	0.168	3.46	1.00	1.00	0.
1093.50	256399.	256399.	103158.	13.68	0.155	3.80	1.00	1.00	0.
1100.00	237596.	237596.	95593.	12.87	0.149	3.94	1.00	1.00	0.
1119.00	184188.	184188.	74105.	10.49	0.130	4.50	1.00	1.00	0.
1125.00	167778.	167778.	67503.	9.75	0.123	4.75	1.00	1.00	0.
1133.00	146395.	146395.	58899.	8.77	0.117	5.09	1.00	1.00	0.
1137.50	134660.	134660.	54178.	8.21	0.112	5.29	1.00	1.00	0.
1142.00	123117.	123117.	49534.	7.66	0.107	5.51	1.00	1.00	0.
1153.00	95799.	95799.	38543.	6.32	0.096	6.20	1.00	1.00	0.
1158.00	83821.	83821.	33724.	5.72	0.090	6.64	1.00	1.00	0.
1169.00	58810.	58810.	23661.	4.42	0.081	7.68	1.00	1.00	0.
1175.00	46341.	46341.	18645.	3.70	0.062	7.81	1.00	1.00	0.
1181.50	34010.	34010.	13683.	2.89	0.076	8.46	1.00	1.00	0.
1183.88	31312.	31312.	12598.	2.70	0.074	8.66	1.00	1.00	0.
1185.00	27794.	27794.	11183.	2.45	0.071	9.23	1.00	1.00	0.
1192.00	16164.	16164.	6503.	1.54	0.056	12.75	1.00	1.00	0.
1196.45	9387.	9387.	3777.	0.97	0.045	16.30	1.00	1.00	0.
1199.00	5760.	5760.	2317.	0.63	0.035	21.36	1.00	1.00	0.
1202.00	1916.	1916.	771.	0.24	0.028	23.87	1.00	1.00	0.
1203.77	0.	0.	0.	0.	8.	0.	1.00	1.00	0.

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F =   2.116   LAMBDA =    0.402(   6   7   0)
```

SURFACE NUMBER   2 ,   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT	X	Y	F(X)
	4- 4	525.00	166.00	1.00
	5- 5	975.00	463.00	1.00
	6- 6	1250.00	488.00	1.00
	7- 7	1285.00	469.50	1.00

INS,IT   0   0
INS,IT   0   2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SHALL F		PORE PRES
553.79	4539.	4539.	1699.	-1.20	-0.068	10.43	1.00	1.00	0.
570.00	23388.	23388.	8754.	2.34	0.083	2.20	1.00	1.00	0.
570.50	24158.	24158.	9042.	2.40	0.085	.13	1.00	1.00	0.
574.00	29869.	29869.	11179.	2.85	0.093	2.73	1.00	1.00	0.
648.47	282874.	282874.	105875.	10.49	0.135	0.73	1.00	1.00	0.
650.00	290698.	290698.	108803.	10.64	0.135	0.72	1.00	1.00	0.
658.00	333372.	333372.	124775.	11.41	0.136	.67	1.00	1.00	0.
662.08	356106.	356106.	133284.	11.81	0.139	.64	1.00	1.00	0.
676.00	387275.	387275.	144950.	14.68	0.163	.91	1.00	1.00	0.
677.00	389624.	389624.	145829.	14.87	0.164	.92	1.00	1.00	0.
678.00	391948.	391948.	146714.	15.07	0.166	.94	1.00	1.00	0.
679.00	394366.	394366.	147604.	15.26	0.167	.95	1.00	1.00	0.
688.00	416430.	416430.	155862.	16.96	0.179	.07	1.00	1.00	0.
693.97	431895.	431895.	161651.	18.02	0.184	1.15	1.00	1.00	0.
720.00	527238.	527238.	197336.	21.51	0.189	1.29	1.00	1.00	0.
725.91	551223.	551223.	206313.	22.23	0.191	.32	1.00	1.00	0.
740.10	611600.	611600.	228911.	23.88	0.194	1.37	1.00	1.00	0.
766.00	713153.	713153.	266920.	27.34	0.202	1.53	1.00	1.00	0.
782.31	782779.	782779.	292980.	29.36	0.209	1.61	1.00	1.00	0.
795.00	849074.	849074.	317793.	30.55	0.212	1.63	1.00	1.00	0.
798.25	866386.	866386.	324273.	30.86	0.212	.63	1.00	1.00	0.
829.00	1014455.	1014455.	379692.	34.49	0.220	1.76	1.00	1.00	0.
830.74	1023238.	1023238.	382980.	34.69	0.221	.76	1.00	1.00	0.
833.00	1036501.	1036501.	387944.	34.89	0.222	.77	1.00	1.00	0.
837.00	1060066.	1060066.	396764.	35.24	0.223	.77	1.00	1.00	0.
839.00	1071896.	1071896.	401192.	35.42	0.224	.77	1.00	1.00	0.
840.00	1077823.	1077823.	403410.	35.51	0.224	1.77	1.00	1.00	0.
841.00	1083758.	1083758.	405631.	35.60	0.224	1.77	1.00	1.00	0.
842.00	1089701.	1089701.	407855.	35.69	0.224	1.78	1.00	1.00	0.
842.50	1092675.	1092675.	408962.	35.74	0.225	.78	1.00	1.00	0.
850.00	1137527.	1137527.	425756.	36.43	0.227	1.79	1.00	1.00	0.
881.40	1334957.	1334957.	499650.	39.34	0.227	1.80	1.00	1.00	0.
890.00	1379933.	1379933.	516484.	40.48	0.229	.84	1.00	1.00	0.
902.27	1445068.	1445068.	540863.	42.08	0.238	1.92	1.00	1.00	0.
905.00	1459537.	1459537.	546279.	42.44	0.240	1.94	1.00	1.00	0.
930.00	1594287.	1594287.	597461.	45.64	0.246	2.06	1.00	1.00	0.
933.00	1613252.	1613252.	603811.	46.01	0.248	2.07	1.00	1.00	0.
942.50	1667568.	1667568.	624141.	47.18	0.252	2.11	1.00	1.00	0.
948.20	1706518.	1706518.	636473.	47.88	0.254	2.13	1.00	1.00	0.
953.19	1729679.	1729679.	647398.	48.49	0.256	.15	1.00	1.00	0.
955.00	1741211.	1741211.	651704.	48.68	0.256	-.16	1.00	1.00	0.
975.00	1870379.	1870379.	700049.	50.83	0.263	.21	1.00	1.00	0.
996.00	1748142.	1748142.	654295.	48.23	0.261	-.31	1.00	1.00	0.
1006.00	1691089.	1691089.	632944.	46.98	0.256	-.34	1.00	1.00	0.
1007.00	1685457.	1685457.	630817.	46.85	0.256	-.35	1.00	1.00	0.
1009.00	1674053.	1674053.	626568.	46.60	0.255	.36	1.00	1.00	0.
1014.00	1645740.	1645740.	615971.	45.97	0.253	-.39	1.00	1.00	0.
1035.00	1527908.	1527908.	571869.	43.34	0.243	2.52	1.00	1.00	0.
1050.03	1444711.	1444711.	540729.	41.45	0.236	-.63	1.00	1.00	0.
1050.26	1443315.	1443315.	540207.	41.43	0.236	.63	1.00	1.00	0.

1057.00	1404082.	1404082.	525523.	40.65	0.233	2.68	1.00	1.00	0.
1072.00	1317294.	1317294.	493040.	38.94	0.227	2.79	1.00	1.00	0.
1080.74	1266927.	1266927.	474198.	37.95	0.224	2.87	1.00	1.00	0.
1093.50	1194572.	1194572.	447107.	36.53	0.219	2.98	1.00	1.00	0.
1100.00	1157958.	1157958.	433403.	35.82	0.218	3.02	1.00	1.00	0.
1119.00	1052514.	1052514.	393937.	33.75	0.213	3.14	1.00	1.00	0.
1125.00	1019643.	1019643.	381649.	33.11	0.211	3.19	1.00	1.00	0.
1133.00	976401.	976401.	365442.	32.26	0.212	3.24	1.00	1.00	0.
1137.50	952343.	952343.	356445.	31.79	0.212	3.27	1.00	1.00	0.
1142.00	928474.	928474.	347511.	31.31	0.211	3.29	1.00	1.00	0.
1153.00	871010.	871010.	326003.	30.16	0.212	3.35	1.00	1.00	0.
1158.00	845320.	845320.	316389.	29.63	0.212	3.38	1.00	1.00	0.
1169.00	790093.	790093.	295718.	28.48	0.218	3.42	1.00	1.00	0.
1175.00	761084.	761084.	284860.	27.83	0.230	3.38	1.00	1.00	0.
1181.50	730768.	730768.	273513.	27.11	0.239	3.37	1.00	1.00	0.
1183.00	723912.	723912.	270947.	26.94	0.241	3.37	1.00	1.00	0.
1185.00	714846.	714846.	267554.	26.71	0.243	3.38	1.00	1.00	0.
1192.00	683765.	683765.	255921.	25.90	0.252	3.41	1.00	1.00	0.
1199.00	653845.	653845.	244723.	25.05	0.268	3.38	1.00	1.00	0.
1202.00	641599.	641599.	240139.	24.67	0.295	3.78	1.00	1.00	0.
1204.00	633828.	633828.	237239.	24.40	0.331	3.72	1.00	1.00	0.
1205.00	630091.	630091.	235832.	24.26	0.352	3.11	1.00	1.00	0.
1211.00	607269.	607269.	227290.	23.36	0.362	3.07	1.00	1.00	0.
1217.50	580236.	580236.	217172.	22.21	0.379	3.99	1.00	1.00	0.
1221.00	564683.	564683.	211351.	21.52	0.389	2.95	1.00	1.00	0.
1231.00	516409.	516409.	193282.	19.35	0.418	2.63	1.00	1.00	0.
1246.00	445277.	445277.	166659.	16.09	0.428	2.76	1.00	1.00	0.
1250.00	400448.	400448.	149850.	14.33	0.545	2.48	1.00	1.00	0.
1253.00	321038.	321038.	120159.	13.00	0.817	4.25	1.00	1.00	0.
1283.11	-0.	-0.	-0.	0.	0.		1.00	1.00	0.

F = 2.446 LAMBDA = 0.374(7 3 9)

EXAMPLE NO. 6

Conventional Stability Analysis Section After Canal
Deepening-Total Stress Analysis Using Laboratory
Strengths With Accelerations of 0.39 and 0.82
for the Upper and Lower Failure
Surface, Respectively

MORGENSTERN AND PRICE METHOD OF SLOPE STABILITY ANALYSIS - DON BANKS

WITH EARTHQUAKE ANALYSIS
LI PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NUMBER OF POINTS   =   95

NUMBER OF LINES   =   102

NUMBER OF MATERIALS =   4

YDM =   185.00

XM   =   650.00

YDP =   415.00

POINT DESCRIPTION

POINT NO.	NO.LINES.	X-COORDINATE	Y-COORDINATE
1	1	0.	150.00
2	2	240.00	150.00
3	2	290.00	160.00
4	2	466.50	165.00
5	2	558.00	170.00
6	2	688.00	179.00
7	2	720.00	181.00
8	2	766.00	190.00
9	2	795.00	200.00
10	2	829.00	210.00
11	2	850.00	220.00
12	2	890.00	230.00
13	2	905.00	240.00
14	2	933.00	250.00
15	2	955.00	260.00
16	2	975.00	270.00
17	2	996.00	280.00
18	2	1035.00	290.00
19	2	1072.00	300.00
20	2	1100.00	310.00
21	2	1125.00	320.00
22	2	1142.00	330.00
23	2	1158.00	340.00
24	2	1169.00	350.00
25	2	1175.00	360.00
26	3	1183.00	370.00
27	3	1192.00	380.00
28	2	1199.00	390.00
29	3	1202.00	400.00
30	3	1204.00	410.00
31	4	1205.00	415.00
32	2	1211.00	420.00
33	2	1221.00	430.00
34	2	1231.00	440.00
35	2	1246.00	450.00
36	2	1253.00	460.00
37	2	1360.00	460.00
38	1	1500.00	465.00
39	2	0.	185.00
40	2	325.00	237.00
41	2	678.00	250.00
42	4	933.00	274.80
43	2	1007.00	318.00
44	2	1119.00	351.20
45	1	1500.00	415.00
46	2	350.00	208.50
47	2	369.00	210.00
48	4	482.50	234.50
49	2	570.00	253.00
50	2	576.00	257.00
51	3	1106.00	304.00
52	3	1093.50	307.00
53	1	0.	216.00
54	2	371.00	241.00
55	2	574.00	261.00
56	2	679.00	276.00
57	4	930.00	301.50
58	1	0.	240.00
59	2	371.00	265.00
60	2	577.00	302.00
61	2	341.00	317.50
62	4	1114.00	321.00
63	3	1133.00	325.00
64	1	0.	286.00
65	2	378.00	311.50
66	2	574.50	321.00
67	2	342.00	340.00
68	4	1137.50	365.00
69	1	0.	304.00
70	2	372.00	329.00
71	2	839.00	348.00
72	4	1153.00	376.00
73	1	0.	324.50
74	2	371.00	349.50
75	2	570.00	352.00
76	2	342.50	368.50
77	4	1181.50	396.00
78	1	0.	360.00
79	2	371.00	385.00
80	2	570.00	380.50
81	2	676.00	382.00
82	2	937.00	400.00
83	4	1199.00	410.00
84	1	0.	414.50
85	2	371.00	439.50
86	2	676.00	411.50
87	2	840.00	423.00
88	3	742.50	447.00
89	2	1157.00	413.00
90	3	1217.50	426.50
91	2	1009.00	457.00
92	2	1185.00	512.00
93	1	1500.00	527.00
94	1	0.	550.00
95	1	1500.00	550.00

C62

LINE DESCRIPTION

LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	2	1
2	2	3	1
3	3	4	1
4	4	5	1
5	5	6	1
6	6	7	1
7	7	8	1
8	8	9	1
9	9	10	1
10	10	11	1
11	11	12	1
12	12	13	1
13	13	14	1
14	14	15	1
15	15	16	1
16	16	17	1
17	17	18	1
18	18	19	1
19	19	52	1
20	52	20	2
21	20	21	2
22	21	63	2
23	63	22	3
24	22	23	3
25	23	24	3
26	24	25	3
27	25	26	3
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36	33	34	4
37	34	35	4
38	35	36	4
39	36	37	4
40	37	38	4
41	39	46	3
42	46	47	3
43	47	48	3
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45	49	50	3
46	50	42	3
47	42	51	3
48	53	54	2
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50	55	56	2
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73	78	79	4
74	79	80	4
75	80	81	4
76	81	82	4
77	82	83	4
78	83	30	4
79	84	85	3
80	85	86	3
81	86	87	3
82	87	88	3
83	88	89	4
84	89	90	4
85	88	91	3
86	91	92	3
87	92	93	3
88	94	95	3
89	39	48	0
90	48	40	0
91	40	41	0
92	41	42	0
93	42	57	0
94	57	43	0
95	43	62	0
96	62	44	0
97	44	68	0
98	68	72	0
99	72	77	0
100	77	83	0
101	83	31	0
102	31	45	0

BvA	0.	240.000000	290.000000	466.500000	658.000000	688.000000	720.000000	766.000000
BvA	795.000000	829.000000	850.000000	890.000000	905.000000	933.000000	955.000000	975.000000
BvA	996.000000	1035.000000	1072.000000	1100.000000	1125.000000	1142.000000	1158.000000	1169.000000
BvA	1175.000000	1183.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000
BvA	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000	0.	525.000000
BvA	678.000000	833.000000	1007.000000	1119.000000	1500.000000	350.000000	369.000000	482.500000
BvA	570.000000	676.000000	1006.000000	1093.500000	0.	371.000000	574.000000	679.000000
BvA	930.000000	0.	371.000000	677.000000	841.000000	1014.000000	1133.000000	0.
BvA	378.000000	570.500000	842.000000	1137.500000	0.	372.000000	839.000000	1153.000000
BvA	0.	371.000000	570.000000	842.500000	1181.500000	0.	371.000000	570.000000
BvA	676.000000	837.000000	1199.000000	0.	371.000000	676.000000	840.000000	942.500000
BvA	1057.000000	1217.500000	1009.000000	1185.000000	1500.000000	0.	1500.000000	725.913040
BvA	1050.264709	1080.777771	650.000000					
BvB	0.	240.000000	290.000000	350.000000	369.000000	371.000000	372.000000	378.000000
BvB	466.500000	482.500000	525.000000	570.000000	570.500000	574.000000	650.000000	658.000000
BvB	676.000000	677.000000	678.000000	679.000000	688.000000	720.000000	725.913040	766.000000
BvB	795.000000	829.000000	833.000000	837.000000	839.000000	840.000000	841.000000	842.000000
BvB	842.500000	850.000000	890.000000	905.000000	930.000000	933.000000	942.500000	955.000000
BvB	975.000000	996.000000	1006.000000	1007.000000	1009.000000	1014.000000	1035.000000	1050.264709
BvB	1057.000000	1072.000000	1080.777771	1093.500000	1100.000000	1119.000000	1125.000000	1133.000000
BvB	1137.500000	1142.000000	1153.000000	1158.000000	1169.000000	1175.000000	1181.500000	1183.000000
BvB	1185.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000	1217.500000
BvB	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000		

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BȲ =    358.509174      70
BȲ =    382.167702      76
BȲ =    411.605183      81
BȲ =    415.000000     104
X  =    678.500000
ȦY =    176.150000       5
BȲ =    250.086451      92
BȲ =    257.315285      46
BȲ =    275.928574      50
BȲ =    302.141769      56
BȲ =    328.558014      61
BȲ =    341.470020      65

BȲ =    358.569725      70
BȲ =    382.279503      76
BȲ =    411.675304      81
BȲ =    415.000000     104
X  =    683.500000
ȦY =    177.650000       5
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BȲ =    257.945858      46
BȲ =    276.457172      51
BȲ =    302.614330      56
BȲ =    328.907921      61
BȲ =    341.673447      65
BȲ =    358.872478      70
BȲ =    382.838509      76
BȲ =    412.025913      81
BȲ =    415.000000     104
X  =    704.000000
ȦY =    180.000000       6
BȲ =    254.495463      92
BȲ =    260.531208      46
BȲ =    278.539841      51
BȲ =    304.551830      56
BȲ =    330.342545      61
BȲ =    342.507496      65
BȲ =    360.113762      70
BȲ =    385.130436      76
BȲ =    413.463413      81
BȲ =    415.000000     104
X  =    722.956520
ȦY =    181.578449       7
BȲ =    257.773129      92
BȲ =    262.921906      46
BȲ =    280.465702      51
BȲ =    306.343452      56
BȲ =    331.669151      61
BȲ =    343.278744      65
BȲ =    361.261589      70
BȲ =    387.249798      76
BȲ =    414.792683      81
BȲ =    415.000000     104
X  =    745.956520
ȦY =    186.078449       7
BȲ =    261.749901      92
BȲ =    265.822540      46
BȲ =    282.802357      51
BȲ =    308.517231      56
BȲ =    333.278725      61
BȲ =    344.214504      65
BȲ =    362.654251      70
BȲ =    389.821224      76
BȲ =    415.000000     104
BȲ =    416.405487      81
X  =    780.500000
ȦY =    195.000000       8
BȲ =    267.722560      92
BȲ =    270.178978      46
BȲ =    286.311752      51
BȲ =    311.782013      56
BȲ =    335.696133      61
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BȲ =    364.745872      70
BȲ =    393.683228      76
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C66

BŶ = 415.000000 104
BŶ = 418.827744 81
X = 812.000000
ɑY = 205.000000 9
BŶ = 273.169033 92
BŶ = 274.151592 46
BŶ = 289.511951 51
BŶ = 314.759148 56
BŶ = 337.900555 61
BŶ = 346.901501 65
BŶ = 366.653214 70
BŶ = 397.204967 76
BŶ = 415.000000 104
BŶ = 421.036587 81
X = 831.000000
ɑY = 210.952381 10
BŶ = 276.454193 92
BŶ = 276.547768 46
BŶ = 291.442230 51
BŶ = 316.554878 56
BŶ = 339.230206 61
BŶ = 347.674519 65
BŶ = 367.803673 70
BŶ = 399.329193 76
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BŶ = 422.368964 81
X = 835.000000
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BŶ = 277.319277 93
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ɑY = 215.000000 10
BŶ = 277.821964 47
BŶ = 278.455154 93
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BŶ = 368.318352 70
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BŶ = 422.964939 81

X = 840.500000
ɑY = 215.476191 10
BŶ = 277.979191 47
BŶ = 278.709743 93
BŶ = 292.407372 51
BŶ = 317.452744 56
BŶ = 339.895027 61
BŶ = 348.133755 66
BŶ = 368.378902 70
BŶ = 400.096684 77
BŶ = 415.000000 104
BŶ = 423.117073 82
X = 841.500000
ɑY = 215.952381 10
BŶ = 278.136414 47
BŶ = 278.964432 93
BŶ = 292.508945 51
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BŶ = 339.965012 61
BŶ = 348.222927 66
BŶ = 368.439453 70
BŶ = 400.124310 77
BŶ = 415.000000 104
BŶ = 423.351219 82
X = 842.250000
ɑY = 216.309525 10
BŶ = 278.254323 47
BŶ = 279.155411 93
BŶ = 292.585159 51
BŶ = 317.525291 57
BŶ = 340.021149 62
BŶ = 348.289806 66
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X = 846.250000
ɑY = 218.214287 10
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BŶ = 340.359558 62
BŶ = 348.646496 66
BŶ = 368.804203 71
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BŶ = 423.351219 82
X = 870.000000
ɑY = 225.000000 11
BŶ = 282.617340 47
BŶ = 286.221649 93
BŶ = 295.404365 51
BŶ = 318.086704 57
BŶ = 342.368866 62
BŶ = 350.764328 66
BŶ = 370.730827 71
BŶ = 400.911602 77
BŶ = 415.000000 104
BŶ = 430.024391 82
X = 897.500000
ɑY = 234.999998 12

C68

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BỸ =   320.949421   57
BỸ =   354.340099   62
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X =   1024.500000
ÅY =   287.307693   17
BỸ =   304.634285   53
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BỸ =   355.439934   62
BỸ =   364.541401   66
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BỸ =   422.650654   83
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ÅY =   292.062790   18
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BỸ =   329.235210   96
BỸ =   356.973972   62
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ÅY =   301.428940   19
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BỸ =   323.097103   58

BỸ =   338.944233   96
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ÅY =   304.928940   19
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BỸ =   415.535046   84
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ÅY =   308.500000   20
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BỸ =   344.800476   96
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BỸ =   370.984074   66
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BỸ =   407.175415   77
BỸ =   415.000000   104
BỸ =   416.343456   84
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X =   1109.500000
ÅY =   313.799999   21
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BỸ =   372.121017   66
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BỸ =   417.415886   84
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X =   1122.000000
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X =   1129.000000
ÅY =   322.500000   22
BỸ =   324.865547   58
BỸ =   358.659462   97
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BỸ =    419.581776    84
BỸ =    496.453125    86
X =   1139.750000
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BỸ =    367.857143    63
BỸ =    377.076920    67
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 ÂY =   369.062500    27
BỸ =    369.917583    63
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BỸ =    396.146343    72
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BỸ =    409.537292    77
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BỸ =    511.140625    86
X =   1184.000000
 ÂY =   371.111115    28
BỸ =    379.179485    67
BỸ =    396.487804    72
BỸ =    398.000000   100
BỸ =    409.585636    77
BỸ =    415.000000   104
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BỸ =    511.687500    86
X =   1188.500000
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 ÂY =   385.000000    29
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BỸ =    407.200001   100
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X =   1200.500000
 ÂY =   394.999992    30
BỸ =    399.707317    72
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X =   1203.000000
 ÂY =   405.000000    31
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X =   1204.500000
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AY =    412.500000     32
BY =    414.583332    101
BY =    415.000000    104
BY =    425.406540     84
BY =    512.928574     87
X =  1208.000000
AY =    415.000000    104
BY =    417.499996     33
BY =    425.700932     84
BY =    513.095238     87
X =  1214.250000
AY =    415.000000    104
BY =    423.250000     34
BY =    426.226635     84
BY =    513.392860     87
X =  1219.250000
AY =    415.000000    104
BY =    428.250000     35
BY =    513.630951     87
X =  1226.000000
AY =    415.000000    104
BY =    435.000000     36
BY =    513.952365     87
X =  1238.500000
AY =    415.000000    104
BY =    445.000000     37
BY =    514.547623     87
X =  1249.500000
AY =    415.000000    104
BY =    455.000004     38
BY =    515.071426     87
X =  1306.500000
AY =    415.000000    104
BY =    460.000000     39
BY =    517.785713     87
X =  1430.000000
AY =    415.000000    104
BY =    462.500000     40
BY =    523.666672     87
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C71

LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NO. OF POINTS TO DESCRIBE FAILURE SURFACES	=	7
NO. OF FAILURE SURFACE DESCRIPTION CARDS	=	2
MAX. NO. OF COLUMNS TO DESCRIBE FAIL. SURF.	=	4
NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES	=	3
NO. OF ALTERNATE F(X) DISTRIBUTIONS	=	0

FAILURE SURFACE POINTS

PRINT NO.	X-COORDINATE	Y-COORDINATE		F(X)
1	600.00	167.00		1.00
	0.00	950.00	378.00	
	1.00	0.00	1205.00	
	409.00	1.00	0.00	
	525.00	166.00	1.00	
	0.00	975.00	463.00	
	1.00	0.00	1250.00	
	488.00	1.00	0.00	
	1285.00	469.50	1.00	

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE			
1	1	2	3	0
2	4	5	6	7

SOIL DATA

NO	WET	SAT	COH	FI	RU	EO
1	135.0	135.0	1000.0	0.	0.	0.390
2	135.0	135.0	2000.0	0.589	0.	0.390
3	135.0	135.0	3000.0	0.640	0.	0.390
4	135.0	135.0	5400.0	0.579	0.	0.390

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SURFACE NUMBER   1 .   1 (SPECIFIED)

SURFACE DEFINED BY#   POINT   X   Y   F(X)
                       1- 1   600.00   167.00   1.00
                       2- 2   950.00   378.00   1.00
                       3- 3   1205.00   409.00   1.00

INS.IT   0 0
INS.IT   0 2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
629.86	-5529.	-5529.	-4512.	-17.01	-1.081	-3.49	1.00	1.00	0.
650.00	19135.	19135.	12351.	22.00	0.804	2.21	1.00	1.00	0.
658.00	29175.	29175.	23809.	46.50	0.516	1.34	1.00	1.00	0.
676.00	68904.	68904.	56229.	12.59	0.336	0.67	1.00	1.00	0.
677.00	71370.	71370.	58241.	12.46	0.330	0.65	1.00	1.00	0.
678.00	73863.	73863.	60275.	12.35	0.325	0.63	1.00	1.00	0.
679.00	76383.	76383.	62332.	12.23	0.319	0.61	1.00	1.00	0.
688.00	100288.	100288.	81839.	11.35	0.277	0.50	1.00	1.00	0.
720.00	214056.	214056.	174679.	10.26	0.176	0.33	1.00	1.00	0.
725.91	240311.	240311.	196104.	10.24	0.169	0.31	1.00	1.00	0.
761.68	426370.	426370.	347937.	10.14	0.135	0.22	1.00	1.00	0.
766.00	452031.	452031.	368870.	10.13	0.131	0.21	1.00	1.00	0.
768.68	468213.	468213.	382083.	10.12	0.130	0.20	1.00	1.00	0.
795.00	496818.	496818.	405626.	13.29	0.157	0.39	1.00	1.00	0.
801.44	505239.	505239.	412298.	14.16	0.164	0.43	1.00	1.00	0.
829.00	585085.	585085.	477455.	17.00	0.179	0.52	1.00	1.00	0.
833.00	597643.	597643.	487703.	17.40	0.182	0.53	1.00	1.00	0.
837.00	610309.	610309.	498040.	17.78	0.185	0.54	1.00	1.00	0.
839.00	616684.	616684.	503241.	17.96	0.186	0.55	1.00	1.00	0.
840.00	619881.	619881.	505850.	18.05	0.187	0.55	1.00	1.00	0.
841.00	623085.	623085.	508465.	18.14	0.188	0.55	1.00	1.00	0.
842.00	626296.	626296.	511086.	18.22	0.188	0.55	1.00	1.00	0.
842.50	627904.	627904.	512398.	18.27	0.189	0.55	1.00	1.00	0.
849.94	652048.	652048.	532100.	18.87	0.193	0.57	1.00	1.00	0.
850.00	652154.	652154.	532187.	18.88	0.193	0.57	1.00	1.00	0.
890.00	743191.	743191.	606477.	24.17	0.216	0.72	1.00	1.00	0.
894.31	754496.	754496.	615702.	24.77	0.222	0.73	1.00	1.00	0.
905.00	797209.	797209.	650558.	25.59	0.231	0.75	1.00	1.00	0.
910.87	820766.	820766.	669782.	25.97	0.231	0.76	1.00	1.00	0.
930.00	873844.	873844.	713096.	28.01	0.239	0.82	1.00	1.00	0.
933.00	882578.	882578.	720223.	28.33	0.241	0.82	1.00	1.00	0.
942.50	910747.	910747.	743210.	29.32	0.246	0.85	1.00	1.00	0.
948.51	928904.	928904.	758027.	29.91	0.249	0.86	1.00	1.00	0.
950.00	935591.	935591.	763484.	29.99	0.249	0.86	1.00	1.00	0.
955.00	915540.	915540.	747122.	29.18	0.246	0.88	1.00	1.00	0.
975.00	836181.	836181.	682361.	25.71	0.232	0.92	1.00	1.00	0.
996.00	754294.	754294.	615538.	21.57	0.208	0.98	1.00	1.00	0.
1006.00	715703.	715703.	584045.	19.50	0.191	1.00	1.00	1.00	0.
1007.00	711850.	711850.	580902.	19.30	0.189	1.01	1.00	1.00	0.
1009.00	704149.	704149.	574617.	18.89	0.185	1.02	1.00	1.00	0.
1014.00	684918.	684918.	558924.	17.88	0.177	1.03	1.00	1.00	0.
1035.00	604484.	604484.	493286.	13.80	0.140	1.12	1.00	1.00	0.
1050.26	546373.	546373.	445865.	11.06	0.115	1.20	1.00	1.00	0.
1057.00	520834.	520834.	425024.	9.91	0.104	1.23	1.00	1.00	0.
1072.00	464176.	464176.	378789.	7.58	0.082	1.33	1.00	1.00	0.
1080.78	431183.	431183.	351864.	6.36	0.070	1.39	1.00	1.00	0.
1093.50	383618.	383618.	313049.	4.80	0.054	1.50	1.00	1.00	0.
1100.00	359459.	359459.	293334.	4.09	0.047	1.54	1.00	1.00	0.
1119.00	289491.	289491.	236238.	2.37	0.029	1.69	1.00	1.00	0.
1125.00	267587.	267587.	218363.	2.01	0.025	1.75	1.00	1.00	0.
1133.00	238590.	238590.	194700.	1.63	0.022	1.84	1.00	1.00	0.
1137.50	222402.	222402.	181490.	1.45	0.020	1.88	1.00	1.00	0.
1142.00	206295.	206295.	168346.	1.32	0.019	1.93	1.00	1.00	0.
1153.00	167297.	167297.	136522.	1.25	0.019	2.08	1.00	1.00	0.
1158.00	149755.	149755.	122207.	1.38	0.022	2.17	1.00	1.00	0.
1169.00	111725.	111725.	91172.	1.94	0.035	2.35	1.00	1.00	0.
1175.00	91473.	91473.	74646.	2.07	0.046	2.33	1.00	1.00	0.
1181.50	70026.	70026.	57144.	1.76	0.046	2.41	1.00	1.00	0.
1183.00	65139.	65139.	53156.	1.64	0.045	2.44	1.00	1.00	0.
1185.00	58656.	58656.	47866.	1.48	0.043	2.55	1.00	1.00	0.
1192.00	36251.	36251.	29582.	0.91	0.033	3.23	1.00	1.00	0.
1196.45	22264.	22264.	18168.	0.59	0.027	3.83	1.00	1.00	0.
1199.00	14360.	14360.	11718.	0.52	0.029	4.68	1.00	1.00	0.
1202.00	5236.	5236.	4273.	0.39	0.046	4.76	1.00	1.00	0.
1203.77	-0.	-0.	-0.	0.	0.	0.	1.00	1.00	0.

F =   1.005 LAMBDA =   0.816(5   6   0)

SOIL DATA

NO	WET	SAT	COH	FI	RU	EO
1	135.0	135.0	1000.0	0.	0.	0.820
2	135.0	135.0	2000.0	0.589	0.	0.820
3	135.0	135.0	3000.0	0.640	0.	0.820
4	135.0	135.0	5400.0	0.579	0.	0.820

SURFACE NUMBER   2 .   1 (SPECIFIED)

SURFACE DEFINED BY#   POINT   X   Y   F(X)
                       4- 4   525.00   166.00   1.00
                       5- 5   975.00   465.00   1.00
                       6- 6   1250.00   488.00   1.00
                       7- 7   1285.00   469.50   1.00

INS.IT   0 0
INS.IT   0 2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
553.79	6817.	6817.	3862.	22.77	1.285	4.59	1.00	1.00	0.
570.00	43775.	43775.	24799.	15.24	0.544	1.13	1.00	1.00	0.
570.50	45300.	45300.	25662.	15.26	0.539	1.10	1.00	1.00	0.
574.00	56620.	56620.	32075.	15.47	0.507	0.95	1.00	1.00	0.
648.47	565121.	565121.	320145.	27.59	0.355	0.24	1.00	1.00	0.
650.00	580915.	580915.	329892.	27.87	0.354	0.24	1.00	1.00	0.
658.00	667078.	667078.	377904.	29.35	0.350	0.22	1.00	1.00	0.
662.08	712996.	712996.	403917.	30.09	0.353	0.21	1.00	1.00	0.
676.00	807662.	807662.	457546.	35.14	0.389	0.41	1.00	1.00	0.
677.00	814764.	814764.	461569.	35.48	0.392	0.42	1.00	1.00	0.
678.00	821906.	821906.	465616.	35.82	0.394	0.43	1.00	1.00	0.
679.00	829089.	829089.	469685.	36.16	0.396	0.44	1.00	1.00	0.
688.00	895543.	895543.	507332.	39.09	0.413	0.50	1.00	1.00	0.
693.97	941905.	941905.	533595.	40.97	0.417	0.55	1.00	1.00	0.
720.00	1204737.	1204737.	682492.	47.63	0.419	0.65	1.00	1.00	0.
725.91	1270628.	1270628.	719820.	49.11	0.422	0.67	1.00	1.00	0.
740.10	1436238.	1436238.	813639.	52.54	0.427	0.71	1.00	1.00	0.
766.00	1731959.	1731959.	981166.	59.57	0.441	0.78	1.00	1.00	0.
782.31	1933760.	1933760.	1095488.	63.64	0.454	0.81	1.00	1.00	0.
795.00	2114558.	2114558.	1197912.	66.06	0.458	0.83	1.00	1.00	0.
798.25	2161746.	2161746.	1224644.	66.66	0.458	0.83	1.00	1.00	0.
829.00	2588335.	2588335.	1466309.	73.31	0.468	0.89	1.00	1.00	0.
830.74	2613583.	2613583.	1480613.	73.67	0.469	0.89	1.00	1.00	0.
833.00	2649653.	2649653.	1501047.	74.04	0.470	0.90	1.00	1.00	0.
837.00	2713735.	2713735.	1537349.	74.69	0.472	0.90	1.00	1.00	0.
839.00	2745902.	2745902.	1555572.	75.02	0.473	0.90	1.00	1.00	0.
840.00	2762017.	2762017.	1564701.	75.18	0.474	0.90	1.00	1.00	0.
841.00	2778153.	2778153.	1573842.	75.33	0.474	0.90	1.00	1.00	0.
842.00	2794310.	2794310.	1582996.	75.49	0.475	0.90	1.00	1.00	0.
842.50	2802396.	2802396.	1587577.	75.57	0.475	0.90	1.00	1.00	0.
850.00	2924322.	2924322.	1656648.	76.73	0.478	0.91	1.00	1.00	0.
881.40	3460430.	3460430.	1960357.	81.56	0.470	0.95	1.00	1.00	0.
890.00	3586906.	3586906.	2032007.	83.54	0.472	0.96	1.00	1.00	0.
902.27	3769909.	3769909.	2135679.	86.24	0.488	0.98	1.00	1.00	0.
905.00	3810561.	3810561.	2158709.	86.81	0.491	0.99	1.00	1.00	0.
930.00	4194058.	4194058.	2375963.	91.86	0.498	1.03	1.00	1.00	0.
933.00	4241541.	4241541.	2402862.	92.45	0.499	1.03	1.00	1.00	0.
942.50	4393465.	4393465.	2488928.	94.28	0.504	1.05	1.00	1.00	0.
948.20	4485566.	4485566.	2541104.	95.35	0.506	1.06	1.00	1.00	0.
953.19	4567038.	4567038.	2587258.	96.27	0.508	1.07	1.00	1.00	0.
955.00	4599875.	4599875.	2605861.	96.54	0.509	1.08	1.00	1.00	0.
975.00	4967543.	4967543.	2814147.	99.36	0.515	1.11	1.00	1.00	0.
996.00	5111335.	5111335.	2895606.	94.83	0.513	1.14	1.00	1.00	0.
1006.00	5176998.	5176998.	2932805.	92.53	0.505	1.14	1.00	1.00	0.
1007.00	5183512.	5183512.	2936495.	92.29	0.504	1.14	1.00	1.00	0.
1009.00	5196511.	5196511.	2943859.	91.82	0.502	1.14	1.00	1.00	0.
1014.00	5228841.	5228841.	2962174.	90.65	0.498	1.15	1.00	1.00	0.
1035.00	5362025.	5362025.	3037624.	85.57	0.480	1.18	1.00	1.00	0.
1050.03	5454646.	5454646.	3090094.	81.81	0.465	1.20	1.00	1.00	0.
1050.28	5455735.	5455735.	3090711.	81.76	0.465	1.20	1.00	1.00	0.

7057.00	5486143.	5486143.	3107937.	80.19	0.460	1.21	1.00	1.00	0.
7072.00	5551940.	5551940.	3145212.	76.64	0.446	1.22	1.00	1.00	0.
7080.78	5589074.	5589074.	3166249.	74.50	0.439	1.23	1.00	1.00	0.
7093.50	5640784.	5640784.	3195543.	71.33	0.428	1.24	1.00	1.00	0.
7100.00	5666051.	5666051.	3209857.	69.67	0.424	1.24	1.00	1.00	0.
7119.00	5734738.	5734738.	3248768.	64.63	0.408	1.24	1.00	1.00	0.
7125.00	5754904.	5754904.	3260193.	62.99	0.402	1.23	1.00	1.00	0.
7133.00	5780182.	5780182.	3274513.	60.74	0.399	1.23	1.00	1.00	0.
7137.50	5793460.	5793460.	3282034.	59.45	0.396	1.23	1.00	1.00	0.
7142.00	5806119.	5806119.	3289206.	58.14	0.392	1.22	1.00	1.00	0.
7153.00	5834183.	5834183.	3305105.	54.84	0.385	1.21	1.00	1.00	0.
7158.00	5845535.	5845535.	3311536.	53.30	0.382	1.21	1.00	1.00	0.
7169.00	5866291.	5866291.	3323294.	49.79	0.381	1.20	1.00	1.00	0.
7175.00	5873973.	5873973.	3327646.	47.77	0.394	1.19	1.00	1.00	0.
7181.50	5878665.	5878665.	3330304.	45.48	0.400	1.18	1.00	1.00	0.
7183.00	5879291.	5879291.	3330659.	44.94	0.402	1.17	1.00	1.00	0.
7185.00	5879877.	5879877.	3330991.	44.22	0.402	1.17	1.00	1.00	0.
7192.00	5879816.	5879816.	3330956.	41.63	0.405	1.17	1.00	1.00	0.
7199.00	5875957.	5875957.	3328770.	38.97	0.417	1.16	1.00	1.00	0.
7202.00	5872421.	5872421.	3326766.	37.78	0.452	1.14	1.00	1.00	0.
7204.00	5868779.	5868779.	3324703.	36.97	0.501	1.13	1.00	1.00	0.
7205.00	5866473.	5866473.	3323397.	36.56	0.531	1.13	1.00	1.00	0.
7211.00	5849159.	5849159.	3313589.	34.05	0.528	1.12	1.00	1.00	0.
7217.50	5823354.	5823354.	3298970.	31.30	0.535	1.11	1.00	1.00	0.
7221.00	5806258.	5806258.	3289285.	29.81	0.538	1.11	1.00	1.00	0.
7231.00	5745060.	5745060.	3254616.	25.48	0.551	1.09	1.00	1.00	0.
7246.00	5638701.	5638701.	3194363.	18.88	0.502	1.08	1.00	1.00	0.
7250.00	5572387.	5572387.	3156795.	17.06	0.649	1.06	1.00	1.00	0.
7253.00	4792917.	4792917.	2715220.	16.18	1.017	1.05	1.00	1.00	0.
7283.11	-7.	-7.	-4.	0.	0.	0.	1.00	1.00	0.

F = 1.000 LAMBDA = 0.567(7 8 0)
STOP AT LINE 5......

EXAMPLE NO. 7

Conventional Stability Analysis Section After Canal
Deepening--Total Stress Analysis Using A Computed
Strength with One Homogeneous Soil Mass Yielding
Equivalent Factors of Safety to That Using
Partitioned Soil Strengths

Strength	Pore Pressure	Acceleration
$c = 0, \phi = 36.11$ deg	0.0	0.0
$c = 0, \phi = 39.95$ deg	0.0	0.0

MORGENSTERN AND PRICE METHOD OF SLOPE STABILITY ANALYSIS - DON BANKS

LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NUMBER OF POINTS = 54

NUMBER OF LINES = 52

NUMBER OF MATERIALS = 1

YDM = 185.00

XM = 650.00

YDM = 415.00

POINT DESCRIPTION

POINT NO.	NO.LINES,	X-COORDINATE	Y-COORDINATE
1	1	0.	150.00
2	2	240.00	150.00
3	2	290.00	180.00
4	2	466.50	165.50
5	2	658.00	170.00
6	2	680.00	179.00
7	2	720.00	181.00
8	2	760.00	190.00
9	2	795.00	200.00
10	2	820.00	210.00
11	2	850.00	220.00
12	2	890.00	230.00
13	2	905.00	240.00
14	2	933.00	250.00
15	2	952.00	260.00
16	2	975.00	270.00
17	2	992.00	280.00
18	2	1035.00	290.00
19	2	1072.00	300.00
20	2	1100.00	310.00
21	2	1125.00	320.00
22	2	1142.00	330.00
23	2	1156.00	340.00
24	2	1169.00	350.00
25	2	1175.00	360.00
26	2	1183.00	370.00
27	2	1192.00	380.00
28	2	1199.00	390.00
29	2	1202.00	400.00
30	2	1204.00	410.00
31	4	1205.00	425.00
32	2	1211.00	420.00
33	2	1221.00	430.00
34	2	1231.00	440.00
35	2	1246.00	450.00
36	2	1253.00	470.50
37	2	1360.00	470.50
38	1	1500.00	470.50
39	1	0.	185.00
40	2	482.50	234.50
41	2	525.00	237.00
42	2	676.00	250.00
43	2	833.00	276.80
44	2	930.00	301.50
45	2	1007.00	318.00
46	2	1014.00	321.00
47	2	1119.00	351.20
48	2	1137.50	365.00
49	2	1153.00	376.00
50	2	1182.50	396.00
51	2	1199.00	410.00
52	1	1500.00	415.00
53	1	0.	550.00
54	1	1500.00	550.00

LINE DESCRIPTION

LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	2	1
2	2	3	1
3	3	4	1
4	4	5	1
5	5	6	1
6	6	7	1
7	7	8	1
8	8	9	1
9	9	10	1
10	10	11	1
11	11	12	1
12	12	13	1
13	13	14	1
14	14	15	1
15	15	16	1
16	16	17	1
17	17	18	1
18	18	19	1
19	19	20	1
20	20	21	1
21	21	22	1
22	22	23	1
23	23	24	1
24	24	25	1
25	25	26	1
26	26	27	1
27	27	28	1
28	28	29	1
29	29	30	1
30	30	31	1
31	31	32	1
32	32	33	1
33	33	34	1
34	34	35	1
35	35	36	1
36	36	37	1
37	37	38	1
38	39	40	0
39	40	41	0
40	41	42	0
41	42	43	0
42	43	44	0
43	44	45	0
44	45	46	0
45	46	47	0
46	47	48	0
47	48	49	0
48	49	50	0
49	50	51	0
50	51	31	0
51	31	52	0
52	53	54	1

C78

BxA	0.	240.000000	290.000000	466.500000	658.000000	688.000000	720.000000	766.000000
BxA	795.000000	829.000000	850.000000	890.000000	905.000000	933.000000	955.000000	975.000000
BxA	998.000000	1035.000000	1072.000000	1100.000000	1125.000000	1142.000000	1158.000000	1160.000000
BxA	1175.000000	1183.000000	1192.000000	1199.000000	1202.000000	1204.000000	1205.000000	1211.000000
BxA	1221.000000	1231.000000	1246.000000	1253.000000	1360.000000	1500.000000	0.	482.500000
BxA	625.000000	678.000000	833.000000	930.000000	1007.000000	1014.000000	1119.000000	1137.500000
BxA	1153.000000	1181.500000	1199.000000	1500.000000	0.	1500.000000	650.000000	
BxB	0.	240.000000	290.000000	466.500000	482.500000	525.000000	650.000000	658.000000
BxB	678.000000	688.000000	720.000000	766.000000	795.000000	829.000000	833.000000	850.000000
BxB	890.000000	905.000000	930.000000	933.000000	955.000000	975.000000	998.000000	1007.000000
BxB	1014.000000	1035.000000	1072.000000	1100.000000	1119.000000	1125.000000	1137.500000	1142.000000
BxB	1153.000000	1158.000000	1160.000000	1175.000000	1181.500000	1183.000000	1192.000000	1199.000000
BxB	1202.000000	1204.000000	1205.000000	1211.000000	1221.000000	1231.000000	1246.000000	1253.000000
BxB	1360.000000	1500.000000						

```
X  =    180.000000
 BY =    150.000000       1
BY =     185.000000      53
BY =     197.310881      38
X  =    265.000000
 BY =    155.000000       2
BY =     185.000000      53
BY =     212.186529      38
X  =    378.250000
 BY =    162.500000       3
BY =     185.000000      53
BY =     223.804922      38
X  =    474.500000
 BY =    165.208878       4
BY =     185.000000      53
BY =     233.679276      38
X  =    503.750000
 BY =    165.972586       4
BY =     185.000000      53
BY =     235.750000      39
X  =    587.500000
 BY =    168.159269       4
BY =     185.000000      53
BY =     242.310457      40
X  =    694.000000
 BY =    169.895561       4
BY =     247.960783      40
BY =     615.000000      54
X  =    668.000000
 BY =    173.000000       5
BY =     249.150326      40
BY =     615.000000      54
X  =    683.000000
 BY =    177.500000       5
BY =     250.864515      41
BY =     615.000000      54
X  =    704.000000
 BY =    180.000000       6
BY =     254.495483      41
BY =     615.000000      54
X  =    743.000000
 BY =    185.500000       7
BY =     261.238708      41
BY =     615.000000      54
X  =    780.500000
 BY =    195.000000       8
BY =     267.722580      41
```

BY = 412.000000   54
X = 812.000000
    Y = 205.000000   9
BY = 273.169033   41
BY = 412.000000   54
X = 831.000000
    BY = 210.952381   10
BY = 276.454193   41
BY = 412.000000   54
X = 841.500000
    BY = 215.952381   10
BY = 278.964432   42
BY = 412.000000   54
X = 870.000000
    BY = 225.000000   11
BY = 286.221649   42
BY = 412.000000   54
X = 887.500000
    BY = 234.999996   12
BY = 293.224228   42
BY = 412.000000   54
X = 917.500000
    BY = 244.464285   13
BY = 298.317009   42
BY = 415.000000   54
X = 931.500000
    BY = 249.464285   13
BY = 301.821438   43
BY = 412.000000   54
X = 944.000000
    BY = 255.000000   14
BY = 304.500000   43
BY = 415.000000   54
X = 965.000000
    BY = 265.000000   15
BY = 309.000000   43
BY = 412.000000   54
X = 985.500000
    BY = 275.000000   16
BY = 313.392857   43
BY = 412.000000   54
X = 1001.500000
    BY = 281.410255   17
BY = 316.821430   43
BY = 412.000000   54
X = 1010.500000
    BY = 283.717949   17
BY = 319.500000   44
BY = 415.000000   54
X = 1024.500000
    BY = 287.307692   17
BY = 324.020000   45
BY = 415.000000   54
X = 1053.500000
    BY = 295.000000   18
BY = 332.360954   45
BY = 412.000000   54
X = 1084.000000
    BY = 305.000000   19
BY = 341.708572   45
BY = 415.000000   54
X = 1109.500000

BY = 313.799999   20
BY = 348.467621   45
BY = 412.000000   54
X = 1122.000000
    BY = 318.799999   20
BY = 353.437840   46
BY = 412.000000   54
X = 1131.250000
    BY = 323.676466   21
BY = 360.337837   46
BY = 412.000000   54
X = 1139.750000
    BY = 328.676466   21
BY = 366.596775   47
BY = 415.000000   54
X = 1147.500000
    BY = 333.437500   22
BY = 372.096775   47
BY = 412.000000   54
X = 1155.500000
    BY = 338.437500   22
BY = 377.754387   48
BY = 412.000000   54
X = 1163.500000
    BY = 344.999996   23
BY = 383.368423   48
BY = 412.000000   54
X = 1172.000000
    BY = 354.999996   24
BY = 389.333336   48
BY = 412.000000   54
X = 1178.250000
    BY = 364.062500   25
BY = 393.719299   48
BY = 412.000000   54
X = 1182.250000
    BY = 369.062500   25
BY = 396.599498   49
BY = 412.000000   54
X = 1187.500000
    BY = 375.000000   26
BY = 400.799999   49
BY = 412.000000   54
X = 1195.500000
    BY = 385.000000   27
BY = 407.200001   49
BY = 412.000000   54
X = 1200.500000
    BY = 394.999992   28
BY = 411.249996   50
BY = 412.000000   54
X = 1203.000000
    BY = 405.000000   29
BY = 413.333332   50
BY = 412.000000   54
X = 1204.500000
    BY = 412.500000   30
BY = 414.583332   50
BY = 415.000000   54
X = 1208.000000
    BY = 415.000000   54
BY = 417.499996   31
X = 1216.000000
    BY = 415.000000   54
BY = 425.000000   32
X = 1226.000000
    BY = 415.000000   54
BY = 435.000000   33
X = 1238.500000
    BY = 415.000000   54
BY = 445.000000   34
X = 1249.500000
    BY = 415.000000   54
BY = 460.250004   35
X = 1306.500000
    BY = 415.000000   54
BY = 470.500000   36
X = 1430.000000
    BY = 415.000000   54
BY = 470.500000   37

LA PITA MILL 2-DIMENSIONAL STABILITY ANALYSIS

NO. OF POINTS TO DESCRIBE FAILURE SURFACES = 7

NO. OF FAILURE SURFACE DESCRIPTION CARDS = 2

MAX. NO. OF COLUMNS TO DESCRIBE FAIL. SURF. = 4

NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES = 1

NO. OF ALTERNATE F(X) DISTRIBUTIONS = 0

FAILURE SURFACE POINTS

POINT NO.	X-COORDINATE	Y-COORDINATE		F(X)
1	600.00	167.69		1.00
	0.00	925.00	166.00	
	1.00	0.00	950.00	
	378.00	1.00	0.00	
	1205.00	409.00	1.00	
	0.00	975.00	463.00	
	1.00	0.00	1250.00	
	488.00	1.00	0.00	
	1285.00	469.50	1.00	

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE			
1	1	3	4	5
2	2	5	6	7

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	0.	0.729	0.	0.

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SURFACE NUMBER   1 / 1 (SPECIFIED)

SURFACE DEFINED BY#   POINT   X   Y   F(X)
                      1- 1   600.00   167.00   1.00
                      3- 3   950.00   378.00   1.00
                      4- 4   1205.00   409.00   1.00

INS,IT 0 0
INS,IT 0 2

X-COORD,	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
629.86	5723,	5723,	21947,	2,00	0,127	1,90	1,00	1,00	0,
650.00	17295,	17295,	6628,	3,47	0,127	1,90	1,00	1,00	0,
658.00	23622,	23622,	9053,	4,06	0,127	1,90	1,00	1,00	0,
678.00	42285,	42285,	16206,	5,66	0,149	1,90	1,00	1,00	0,
688.00	52828,	52828,	20249,	6,51	0,158	1,90	1,00	1,00	0,
720.00	95234,	95234,	36500,	8,98	0,154	1,90	1,00	1,00	0,
761.68	169504,	169504,	64964,	12,11	0,161	1,90	1,00	1,00	0,
766.00	178288,	178288,	68331,	12,44	0,161	1,90	1,80	1,00	0,
795.00	240783,	240783,	92283,	14,74	0,174	1,90	1,80	1,00	0,
829.00	322205,	322205,	123489,	17,52	0,184	1,90	1,00	1,00	0,
833.00	332371,	332371,	127385,	17,85	0,187	1,90	1,00	1,00	0,
850.00	376178,	376178,	144175,	19,28	0,197	1,90	1,80	1,00	0,
890.00	487931,	487931,	187006,	22,62	0,202	1,90	1,00	1,00	0,
905.00	532470,	532470,	204076,	23,89	0,215	1,90	1,00	1,00	0,
930.00	608429,	608429,	233168,	26,05	0,223	1,90	1,00	1,00	0,
933.00	617820,	617820,	236787,	26,31	0,223	1,90	1,80	1,00	0,
950.00	671770,	671770,	257464,	27,78	0,231	1,90	1,00	1,00	0,
955.00	652997,	652997,	250254,	27,25	0,230	1,90	1,00	1,00	0,
975.00	580612,	580612,	222529,	25,09	0,226	1,90	1,80	1,00	0,
996.00	509617,	509617,	195317,	22,71	0,219	1,90	1,00	1,00	0,
1007.00	473977,	473977,	181658,	21,43	0,210	1,90	1,00	1,00	0,
1014.00	451564,	451564,	173068,	20,62	0,204	1,90	1,00	1,00	0,
1035.00	385575,	385575,	147776,	18,18	0,185	1,90	1,00	1,00	0,
1072.00	274165,	274165,	105077,	13,94	0,150	1,90	1,00	1,00	0,
1100.00	195191,	195191,	74809,	10,79	0,125	1,90	1,00	1,00	0,
1119.00	145158,	145158,	55634,	8,69	0,107	1,90	1,00	1,00	0,
1125.00	130016,	130016,	49830,	8,04	0,101	1,90	1,00	1,00	0,
1137.50	99948,	99948,	38306,	6,70	0,091	1,90	1,00	1,00	0,
1142.00	89685,	89685,	34373,	6,22	0,087	1,90	1,00	1,00	0,
1193.00	65923,	65923,	25266,	5,07	0,077	1,90	1,00	1,00	0,
1156.00	55757,	55757,	21369,	4,56	0,072	1,90	1,00	1,00	0,
1169.00	35327,	35327,	13540,	3,51	0,064	1,90	1,00	1,00	0,
1175.00	25879,	25879,	9918,	2,95	0,065	1,90	1,00	1,00	0,
1181.50	17343,	17343,	6647,	2,29	0,060	1,90	1,00	1,00	0,
1183.00	15586,	15586,	5974,	2,14	0,059	1,90	1,00	1,00	0,
1192.00	6950,	6950,	2510,	1,18	0,043	1,90	1,00	1,00	0,
1196.40	3113,	3113,	1193,	0,70	0,033	1,90	1,00	1,00	0,
1199.00	1912,	1912,	580,	0,44	0,024	1,90	1,00	1,00	0,
1202.00	241,	241,	92,	0,15	0,018	1,90	1,00	1,00	0,
1203.77	-0,	-0,	-0,	0,	0,	0,	1,00	1,00	0,

F = 2.116 LAMBDA = 0.383(7 8 9)

	SOIL DATA					
NO	WET	SAT	COH	PI	RU	EQ
1	135.0	135.0	0,	0,806	0,	0,

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SURFACE NUMBER   2 >   1 (SPECIFIED)

SURFACE DEFINED BY:	POINT	X	Y	F(X)
	2- 2	525.00	166.00	1.00
	5- 5	975.00	463.00	1.00
	6- 6	1250.00	488.00	1.00
	7- 7	1285.00	469.90	1.00

INI;IT 0 0
INI;IT 0 2

X-COORD	E	X-FORCE	V-YY	V-VT/V-Z	VERT F	SMALL F		PORE PRES
553.79	8215.	8215.	3072.	2.67	0.150	2.16	1.00 1.00	0.
648.47	158103.	158103.	59111.	11.70	0.150	2.16	1.00 1.00	0.
650.00	162009.	162009.	60594.	11.84	0.150	2.16	1.00 1.00	0.
668.00	183626.	183626.	68653.	12.61	0.150	2.16	1.00 1.00	0.
678.00	241588.	241588.	90323.	14.61	0.161	2.16	1.00 1.00	0.
688.00	272359.	272359.	101828.	15.66	0.166	2.16	1.00 1.00	0.
720.00	382866.	382866.	143151.	18.93	0.166	2.16	1.00 1.00	0.
766.00	572646.	572646.	214098.	23.58	0.175	2.16	1.00 1.00	0.
795.00	706946.	706946.	264309.	26.60	0.184	2.16	1.00 1.00	0.
829.00	876568.	876568.	327726.	30.23	0.193	2.16	1.00 1.00	0.
833.00	897398.	897398.	335514.	30.66	0.195	2.16	1.00 1.00	0.
850.00	987011.	987011.	369018.	32.51	0.203	2.16	1.00 1.00	0.
890.00	1210818.	1210818.	452693.	36.87	0.208	2.16	1.00 1.00	0.
902.27	1282807.	1282807.	479608.	38.22	0.216	2.16	1.00 1.00	0.
905.00	1298800.	1298800.	485588.	38.52	0.218	2.16	1.00 1.00	0.
930.00	1448534.	1448534.	541569.	41.32	0.224	2.16	1.00 1.00	0.
933.00	1466924.	1466924.	548445.	41.66	0.225	2.16	1.00 1.00	0.
955.00	1603765.	1603765.	599606.	44.13	0.232	2.16	1.00 1.00	0.
975.00	1730726.	1730726.	647073.	46.40	0.240	2.16	1.00 1.00	0.
996.00	1594274.	1594274.	596058.	44.18	0.239	2.16	1.00 1.00	0.
1007.00	1524674.	1524674.	570036.	43.01	0.235	2.16	1.00 1.00	0.
1014.00	1480741.	1480741.	553611.	42.28	0.232	2.16	1.00 1.00	0.
1035.00	1350617.	1350617.	504961.	40.12	0.225	2.16	1.00 1.00	0.
1072.00	1127784.	1127784.	421649.	36.55	0.213	2.16	1.00 1.00	0.
1100.00	965937.	965937.	361139.	34.10	0.207	2.16	1.00 1.00	0.
1119.00	860466.	860466.	321706.	32.57	0.206	2.16	1.00 1.00	0.
1125.00	827996.	827996.	309551.	32.12	0.205	2.16	1.00 1.00	0.
1137.50	761963.	761963.	284878.	31.21	0.208	2.16	1.00 1.00	0.
1142.00	738859.	738859.	276240.	30.90	0.209	2.16	1.00 1.00	0.
1153.00	683919.	683919.	255699.	30.14	0.212	2.16	1.00 1.00	0.
1158.00	659680.	659680.	246637.	29.81	0.213	2.16	1.00 1.00	0.
1169.00	608563.	608563.	227526.	29.07	0.223	2.16	1.00 1.00	0.
1175.00	582585.	582585.	217813.	28.63	0.236	2.16	1.00 1.00	0.
1181.50	556340.	556340.	208001.	28.10	0.247	2.16	1.00 1.00	0.
1183.00	550523.	550523.	205826.	27.97	0.250	2.16	1.00 1.00	0.
1192.00	517309.	517309.	193408.	27.14	0.264	2.16	1.00 1.00	0.
1199.00	493708.	493708.	184585.	26.41	0.283	2.16	1.00 1.00	0.
1202.00	484578.	484578.	181171.	26.05	0.311	2.16	1.00 1.00	0.
1204.00	479164.	479164.	179147.	25.78	0.349	2.16	1.00 1.00	0.
1205.00	476710.	476710.	178229.	25.63	0.372	2.16	1.00 1.00	0.
1211.00	461859.	461859.	172677.	24.61	0.382	2.16	1.00 1.00	0.
1221.00	432834.	432834.	161825.	22.48	0.406	2.16	1.00 1.00	0.
1231.00	398511.	398511.	148993.	15.88	0.430	2.16	1.00 1.00	0.
1246.00	349215.	349215.	130562.	15.91	0.423	2.16	1.00 1.00	0.
1250.00	309511.	309511.	115718.	13.68	0.521	2.16	1.00 1.00	0.
1253.00	232781.	232781.	87031.	12.51	0.786	2.16	1.00 1.00	0.
1285.11	-0.	-0.	-0.	0.	0.	0.	1.00 1.00	0.

F = 2.446   LAMBDA =   0.374(6   7   0)
STOP AT LINE   5....

EXAMPLE NO. 8

Conventional Stability Analysis Section After Canal Deepening--
Total Stress Analysis Using A Computed Strength of c = 0
and ϕ = 36.11 deg for the Lower Failure Surface with
Distributed Accelerations Applied to the Failure Mass

MORGENSTERN AND PRICE METHOD OF SLOPE STABILITY ANALYSIS - DON BANKS

WITH EARTHQUAKE ANALYSIS
LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NUMBER OF POINTS   =   80

NUMBER OF LINES   =   78

NUMBER OF MATERIALS =   28

YDM =   185.00

XM =   650.00

YDP =   415.00

POINT DESCRIPTION

POINT NO.	NO.LINES.	X-COORDINATE	Y-COORDINATE		POINT NO.	NO.LINES.	X-COORDINATE	Y-COORDINATE
1	1	0.	150.00		59	2	279.50	158.00
2	2	240.00	150.00		60	2	336.00	162.00
3	2	290.00	160.00		61	2	400.00	163.00
4	2	466.50	165.00		62	2	467.50	165.00
5	2	658.00	170.00		63	2	536.00	167.00
6	2	688.00	179.00		64	2	585.50	168.00
7	2	720.00	181.00		65	2	639.00	169.50
8	2	766.00	190.00		66	2	695.00	180.00
9	2	795.00	200.00		67	2	734.50	185.00
10	2	829.00	210.00		68	2	774.50	193.00
11	2	850.00	220.00		69	2	816.00	207.00
12	2	890.00	230.00		70	2	847.00	218.00
13	2	905.00	240.00		71	2	880.00	228.00
14	2	933.00	250.00		72	2	913.50	242.50
15	2	955.00	260.00		73	2	947.00	257.00
16	2	975.00	270.00		74	2	981.50	273.00
17	2	996.00	280.00		75	2	1016.50	287.00
18	2	1035.00	290.00		76	2	1046.00	292.00
19	2	1072.00	300.00		77	2	1076.00	302.00
20	2	1100.00	310.00		78	2	1095.50	308.00
21	2	1125.00	320.00		79	2	1112.50	315.00
22	2	1142.00	330.00		80	2	1131.00	318.00
23	2	1158.00	340.00					
24	2	1169.00	350.00					
25	2	1175.00	360.00					
26	2	1183.00	370.00					
27	2	1192.00	380.00					
28	2	1199.00	390.00					
29	2	1202.00	400.00					
30	2	1204.00	410.00					
31	4	1205.00	415.00					
32	2	1211.00	420.00					
33	2	1221.00	430.00					
34	2	1231.00	440.00					
35	2	1246.00	450.00					
36	2	1293.00	470.50					
37	2	1360.00	470.50					
38	1	1500.00	470.50					
39	1	0.	185.00					
40	2	482.50	234.50					
41	2	525.00	237.00					
42	2	678.00	250.00					
43	2	833.00	276.80					
44	2	930.00	301.50					
45	2	1007.00	318.00					
46	2	1014.00	321.00					
47	2	1119.00	351.20					
48	2	1137.50	365.00					
49	2	1153.00	376.00					
50	2	1181.50	396.00					
51	2	1199.00	410.00					
52	1	1500.00	415.00					
53	1	0.	550.00					
54	1	1500.00	550.00					
55	2	60.00	150.00					
56	2	132.50	150.00					
57	2	191.00	150.00					
58	2	238.50	150.00					

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LINE DESCRIPTION

LINE NO.	POINT 1	POINT 2	MATERIAL
1	1	55	1
2	55	56	2
3	56	57	3
4	57	58	4
5	58	2	5
6	2	59	5
7	59	3	6
8	3	60	6
9	60	61	7
10	61	4	8
11	4	62	8
12	62	63	9
13	63	64	10
14	64	65	11
15	65	5	12
16	5	6	12
17	6	66	12
18	66	7	13
19	7	67	13
20	67	8	14
21	8	68	14
22	68	9	15
23	9	69	15
24	69	10	16
25	10	70	16
26	70	11	17
27	11	71	17
28	71	12	18
29	12	13	18
30	13	72	18
31	72	14	19
32	14	73	19
33	73	15	20
34	15	16	20
35	16	74	20
36	74	17	21
37	17	75	21
38	75	18	22
39	18	76	22
40	76	19	23
41	19	77	23
42	77	78	24
43	78	20	25
44	20	79	25
45	79	21	26
46	21	80	26
47	80	22	27
48	22	23	27
49	23	24	27
50	24	25	27
51	25	26	27
52	26	27	27
53	27	28	27
54	28	29	27
55	29	30	27
56	30	31	27
57	31	32	27
58	32	33	27
59	33	34	27
60	34	35	27
61	35	36	27
62	36	37	28
63	37	38	28
64	39	40	0
65	40	41	0
66	41	42	0
67	42	43	0
68	43	44	0
69	44	45	0
70	45	46	0
71	46	47	0
72	47	48	0
73	48	49	0
74	49	50	0
75	50	51	0
76	51	31	0
77	31	52	0
78	53	54	28

C87

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BXA     0,          240,000000   290,000000   468,500000   658,000000   688,000000   720,000000   766,000000
BXA     795,000000  829,000000   850,000000   890,000000   905,000000   933,000000   952,000000   975,000000
BXA     996,000000  1035,000000  1072,000000  1100,000000  1125,000000  1142,000000  1158,000000  1169,000000
BXA     1172,000000 1183,000000  1192,000000  1199,000000  1202,000000  1204,000000  1207,000000  1211,000000
BXA     1221,000000 1231,000000  1246,000000  1253,000000  1360,000000  1500,000000  0,           482,500000
BXA     527,000000  678,000000   833,000000   930,000000   1007,000000  1014,000000  1119,000000  1137,500000
BXA     1156,000000 1181,500000  1199,000000  1500,000000  0,           1500,000000  60,000000    132,500000
BXA     191,000000  238,500000   279,500000   336,000000   400,000000   467,500000   539,000000   585,500000
BXA     639,000000  695,000000   734,500000   774,500000   816,000000   847,000000   880,000000   913,500000
BXA     947,000000  981,500000   1016,500000  1046,000000  1076,000000  1095,500000  1112,500000  1131,000000
BXA     850,000000
BXB     0,          60,000000    132,500000   191,000000   238,500000   240,000000   279,500000   290,000000
BXB     336,000000  400,000000   466,500000   467,500000   482,500000   525,000000   538,000000   585,500000
BXB     639,000000  658,000000   658,600000   678,000000   688,000000   695,000000   720,000000   734,500000
BXB     766,000000  774,500000   795,000000   816,000000   829,000000   833,000000   847,000000   850,000000
BXB     880,000000  890,000000   905,000000   913,500000   930,000000   933,000000   947,000000   955,000000
BXB     975,000000  981,500000   996,000000   1007,000000  1014,000000  1016,500000  1035,000000  1046,000000
BXB     1072,000000 1076,000000  1095,500000  1100,000000  1112,500000  1119,000000  1125,000000  1131,000000
BXB     1137,500000 1142,000000  1153,000000  1158,000000  1169,000000  1175,000000  1181,500000  1183,000000
BXB     1192,000000 1199,000000  1202,000000  1204,000000  1205,000000  1211,000000  1221,000000  1231,000000
BXB     1246,000000 1253,000000  1360,000000  1500,000000
X  =     30,000000
  BY =    10,000000      1
  Y  =   185,000000     79
 BY =    180,077721     64
X  =     96,250000
  BY =   150,000000      2
  BY =   185,000000     79
  BY =   194,874352     64
X  =    161,750000
  BY =   150,000000      3
  BY =   185,000000     79
  BY =   201,594642     64
X  =    214,750000
  BY =   150,000000      4
  BY =   185,000000     79
  BY =   207,031347     64
X  =    239,250000
  BY =   150,000000      5
  BY =   185,000000     79
  BY =   209,544819     64
X  =    289,750000
  BY =   174,000000      6
  BY =   185,000000     79
  BY =   211,647928     64
X  =    284,750000
  BY =   159,000000      7
  BY =   185,000000     79
  BY =   214,212694     64
X  =    313,000000
  BY =   191,000000      8
  BY =   185,000000     79
  BY =   217,110880     64
X  =    368,000000
  BY =   192,500000      9
  BY =   185,000000     79
  BY =   222,753368     64
X  =    433,250000
  BY =   194,000000     10
  BY =   185,000000     79
  BY =   229,447409     64
```

X = 467.000000
BY = 185.000000   11
BY = 185.000000   79
BY = 232.909843   64
X = 475.000000
BY = 185.218977   12
BY = 185.000000   79
BY = 233.730970   64
X = 503.750000
BY = 196.058393   12
BY = 185.000000   79
BY = 235.750000   69
X = 530.500000
BY = 196.039417   12
BY = 185.000000   79
BY = 237.467319   66
X = 560.750000
BY = 187.500000   13
BY = 185.000000   79
BY = 240.037980   66
X = 612.250000
BY = 188.750000   14
BY = 185.000000   79
BY = 244.413399   66
X = 664.500000
BY = 189.844733   15
BY = 185.000000   79
BY = 247.193999   66
X = 684.000000
BY = 189.844733   15
BY = 247.960783   66
BY = 415.000000   80
X = 668.000000
BY = 173.000000   16
BY = 249.150326   66
BY = 415.000000   80
X = 683.000000
BY = 177.500000   16
BY = 250.864515   67
BY = 415.000000   80
X = 691.500000
BY = 179.500000   17
BY = 252.334194   67
BY = 415.000000   80
X = 787.500000
BY = 190.500000   18
BY = 255.100645   67
BY = 415.000000   80
X = 727.250000
BY = 193.000000   19
BY = 258.515484   67
BY = 415.000000   80
X = 760.250000
BY = 187.500000   20
BY = 262.492256   67
BY = 415.000000   80
X = 770.250000
BY = 171.500000   21
BY = 265.950321   67
BY = 415.000000   80
X = 784.750000
BY = 196.500000   22

BY = 268.457420   67
BY = 415.000000   80
X = 805.500000
BY = 203.500000   23
BY = 272.045162   67
BY = 415.000000   80
X = 822.500000
BY = 208.500000   24
BY = 274.984516   67
BY = 415.000000   80
X = 831.000000
BY = 210.888887   25
BY = 276.454193   67
BY = 415.000000   80
X = 840.000000
BY = 214.888887   25
BY = 278.582474   68
BY = 415.000000   80
X = 848.500000
BY = 219.000000   26
BY = 280.746906   68
BY = 415.000000   80
X = 865.000000
BY = 224.000000   27
BY = 284.948452   68
BY = 415.000000   80
X = 885.000000
BY = 229.000000   28
BY = 290.041237   68
BY = 415.000000   80
X = 897.500000
BY = 234.999998   29
BY = 293.224228   68
BY = 415.000000   80
X = 909.250000
BY = 241.250000   30
BY = 296.216236   68
BY = 415.000000   80
X = 921.750000
BY = 249.673077   31
BY = 299.399227   68
BY = 415.000000   80
X = 931.500000
BY = 249.423077   31
BY = 301.821430   69
BY = 415.000000   80
X = 940.000000
BY = 253.500000   32
BY = 303.642857   69
BY = 415.000000   80
X = 951.000000
BY = 258.500000   33
BY = 309.000000   69
BY = 415.000000   80
X = 965.000000
BY = 265.000000   34
BY = 309.000000   69
BY = 978.250000
X = 978.250000
BY = 271.500000   35
BY = 311.839287   69
BY = 415.000000   80

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X =    988,750000
   BY =    276,500000    36
  BY =    314,089287     69
  BY =    415,000000     80
X =   1001,500000
   BY =    281,878048    37
  BY =    316,821430     69
  BY =    415,000000     80
X =   1010,500000
   BY =    284,951218    37
  BY =    319,500000     70
  BY =    415,000000     80
X =   1015,250000
   BY =    286,573170    37
  BY =    321,359524     71
  BY =    415,000000     80
X =   1025,750000
   BY =    288,500000    38
  BY =    324,379524     71
  BY =    415,000000     80
X =   1040,500000
   BY =    291,000000    39
  BY =    328,621906     71
  BY =    415,000000     80
X =   1059,000000
   BY =    296,000000    40
  BY =    333,942856     71
  BY =    415,000000     80
X =   1074,000000
   BY =    301,000000    41
  BY =    338,257145     71
  BY =    415,000000     80
X =   1085,750000
   BY =    305,000000    42
  BY =    341,636669     71
  BY =    415,000000     80
X =   1097,750000
   BY =    309,000000    43
  BY =    345,088097     71
  BY =    415,000000     80
X =   1106,250000
   BY =    312,500000    44
  BY =    347,532856     71
  BY =    415,000000     80
X =   1115,750000
   BY =    316,299999    45
  BY =    350,265240     71
  BY =    415,000000     80
X =   1122,000000
   BY =    318,799999    45
  BY =    353,437840     72
  BY =    415,000000     80
X =   1128,000000
   BY =    319,000000    46
  BY =    357,913513     72
  BY =    415,000000     80
X =   1134,250000
   BY =    321,945456    47
  BY =    362,575676     72
  BY =    415,000000     80
X =   1139,750000
   BY =    327,545456    47
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```
  BY =    366,596775     73
  BY =    415,000000     80
X =   1147,500000
   BY =    353,437500    48
  BY =    372,096775     73
  BY =    415,000000     80
X =   1155,500000
   BY =    338,437500    48
  BY =    377,754387     74
  BY =    415,000000     80
X =   1163,500000
   BY =    344,999996    49
  BY =    383,368423     74
  BY =    415,000000     80
X =   1172,000000
   BY =    354,999998    50
  BY =    389,333336     74
  BY =    415,000000     80
X =   1178,250000
   BY =    364,062500    51
  BY =    393,719299     74
  BY =    415,000000     80
X =   1182,250000
   BY =    369,062500    51
  BY =    396,599998     75
  BY =    415,000000     80
X =   1187,500000
   BY =    375,000000    52
  BY =    400,799999     75
  BY =    415,000000     80
X =   1195,500000
   BY =    385,000000    53
  BY =    407,200001     75
  BY =    415,000000     80
X =   1200,500000
   BY =    394,999992    54
  BY =    411,249996     76
  BY =    415,000000     80
X =   1203,000000
   BY =    405,000000    55
  BY =    413,333332     76
  BY =    415,000000     80
X =   1204,500000
   BY =    412,500000    96
  BY =    414,583332     76
  BY =    415,000000     80
X =   1208,000000
  BY =    415,000000     80
  BY =    417,499996     57
X =   1216,000000
   BY =    415,000000    80
  BY =    425,000000     58
X =   1226,000000
   BY =    415,000000    80
  BY =    435,000000     59
X =   1238,500000
   BY =    415,000000    80
  BY =    445,000000     60
X =   1249,500000
   BY =    415,000000    80
  BY =    460,250004     61
X =   1306,500000
   BY =    415,000000    80
  BY =    470,500000     62
X =   1430,000000
   BY =    415,000000    80
  BY =    470,500000     63
```

LA PITA HILL 2-DIMENSIONAL STABILITY ANALYSIS

NO. OF POINTS TO DESCRIBE FAILURE SURFACES = 7

NO. OF FAILURE SURFACE DESCRIPTION CARDS = 2

MAXI NO. OF COLUMNS TO DESCRIBE FAIL, SURF, = 4

NO. OF BLOCKS OF SUBSTITUTE SOIL TYPES = 8

NO. OF ALTERNATE F(X) DISTRIBUTIONS = 0

FAILURE SURFACE POINTS

POINT NO.	X-COORDINATE	Y-COORDINATE		F(X)
1	600.00	167.00		1.00
	0.00	525.00	168.00	
	1.00	0.00	950.00	
	378.00	1.00	0.00	
	1205.00	409.00	1.00	
	0.00	975.00	463.00	
	1.00	0.00	1250.00	
	488.00	1.00	0.00	
	1285.00	469.50	1.00	

FAILURE SURFACE DESCRIPTION

SURFACE NO.	POINTS TO DESCRIBE THE SURFACE			
1	1	3	4	0
2	2	5	6	7

SOIL DATA

NO	WET	SAT	COM	FI	RU	EQ
1	135.0	135.0	0.	0.729	0.	0.010
2	135.0	135.0	0.	0.729	0.	0.010
3	135.0	135.0	0.	0.729	0.	0.010
4	135.0	135.0	0.	0.729	0.	0.020
5	135.0	135.0	0.	0.729	0.	0.020
6	135.0	135.0	0.	0.729	0.	0.020
7	135.0	135.0	0.	0.729	0.	0.030
8	135.0	135.0	0.	0.729	0.	0.030
9	135.0	135.0	0.	0.729	0.	0.040
10	135.0	135.0	0.	0.729	0.	0.050
11	135.0	135.0	0.	0.729	0.	0.060
12	135.0	135.0	0.	0.729	0.	0.080
13	135.0	135.0	0.	0.729	0.	0.100
14	135.0	135.0	0.	0.729	0.	0.120
15	135.0	135.0	0.	0.729	0.	0.160
16	135.0	135.0	0.	0.729	0.	0.200
17	135.0	135.0	0.	0.729	0.	0.240
18	135.0	135.0	0.	0.729	0.	0.320
19	135.0	135.0	0.	0.729	0.	0.400
20	135.0	135.0	0.	0.729	0.	0.600
21	135.0	135.0	0.	0.729	0.	0.800
22	135.0	135.0	0.	0.729	0.	1.200
23	135.0	135.0	0.	0.729	0.	2.000
24	135.0	135.0	0.	0.729	0.	3.000
25	135.0	135.0	0.	0.729	0.	4.000
26	135.0	135.0	0.	0.729	0.	6.000
27	135.0	135.0	0.	0.729	0.	10.000
28	135.0	135.0	0.	0.729	0.	0.

SURFACE NUMBER   2 ,   1 (SPECIFIED)

SURFACE DEFINED BY:	POINT		X	Y	F(X)
	2=	2	925.00	166.00	1.00
	5=	5	975.00	463.00	1.00
	6=	6	1250.00	488.00	1.00
	7=	7	1285.00	469.50	1.00

INS,IT 0 0
INS,IT 0 2

X-COORD	E	E	X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SHALL F		PORE PRES
536.00	-89.	-89.	-42.	-3.22	-0.514	1.56	1.00	1.00	0.
593.70	-401.	-401.	-188.	-21.77	-1.234	1.56	1.00	1.00	0.
585.50	-1697.	-1697.	-793.	-52.51	-1.384	1.56	1.00	1.00	0.
639.00	-1986.	-1936.	-905.	-383.61	-5.347	1.56	1.00	1.00	0.
648.47	-27.	-27.	-12.	-50591.32	-495.889	1.56	1.00	1.00	0.
650.00	296.	296.	138.	3640.29	46.249	1.56	1.00	1.00	0.
658.00	2049.	2049.	958.	665.82	7.947	1.56	1.00	1.00	0.
678.00	6763.	6763.	3161.	328.23	3.586	1.56	1.00	1.00	0.
688.00	9266.	9266.	4330.	289.95	3.066	1.56	1.00	1.00	0.
695.00	11085.	11085.	5181.	275.27	2.803	1.56	1.00	1.00	0.
720.00	25590.	25590.	11960.	196.82	1.731	1.56	1.00	1.00	0.
734.50	34839.	34839.	16283.	185.11	1.552	1.56	1.80	1.00	0.
766.00	67905.	67905.	31737.	160.37	1.187	1.56	1.00	1.00	0.
774.50	77473.	77473.	36209.	198.63	1.192	1.56	1.00	1.00	0.
795.00	117378.	117378.	54859.	149.44	1.009	1.56	1.00	1.00	0.
816.00	160199.	160199.	74872.	140.93	0.933	1.56	1.80	1.00	0.
829.00	198989.	198939.	92978.	136.63	0.872	1.56	1.00	1.00	0.
833.00	211100.	211100.	98666.	139.81	0.862	1.56	1.00	1.00	0.
847.00	254227.	254227.	118818.	134.04	0.835	1.56	1.00	1.00	0.
850.00	266230.	266230.	124428.	133.27	0.830	1.56	1.90	1.00	0.
880.00	390665.	390665.	182585.	130.13	0.755	1.56	1.00	1.00	0.
890.00	453593.	453593.	211996.	128.38	0.726	1.56	1.00	1.00	0.
902.27	531823.	531823.	248558.	127.28	0.720	1.56	1.80	1.00	0.
905.00	549202.	549202.	256681.	127.12	0.719	1.56	1.00	1.00	0.
913.50	603842.	603842.	282218.	126.85	0.705	1.56	1.00	1.00	0.
930.00	745993.	745993.	348469.	129.44	0.680	1.56	1.00	1.00	0.
933.00	771746.	771746.	360692.	185.35	0.677	1.56	1.00	1.00	0.
947.00	894809.	894809.	418206.	129.30	0.668	1.56	1.80	1.00	0.
955.00	1007915.	1007915.	471070.	124.13	0.654	1.56	1.00	1.00	0.
975.00	1294797.	1294797.	605150.	122.97	0.637	1.56	1.80	1.00	0.
981.50	1290665.	1290665.	603210.	128.42	0.674	1.56	1.00	1.00	0.
996.00	1384904.	1384904.	647264.	134.34	0.727	1.56	1.00	1.00	0.
1007.00	1454805.	1454805.	679933.	137.59	0.755	1.56	1.80	1.00	0.
1014.00	1498740.	1498740.	700467.	139.25	0.772	1.56	1.80	1.00	0.
1016.50	1514328.	1514328.	707753.	139.77	0.778	1.56	1.80	1.00	0.
1035.00	1880592.	1880592.	878934.	131.83	0.739	1.56	1.00	1.00	0.
1046.00	2096961.	2096961.	980058.	127.75	0.720	1.56	1.00	1.00	0.
1072.00	3288182.	3288182.	1536800.	106.01	0.617	1.56	1.00	1.00	0.
1076.00	3467631.	3467631.	1620669.	103.61	0.609	1.56	1.00	1.00	0.
1095.50	4949395.	4949395.	2313203.	88.86	0.536	1.56	1.89	1.00	0.
1100.00	5426465.	5426465.	2536171.	85.55	0.521	1.56	1.00	1.00	0.
1112.50	6729774.	6729774.	3145300.	77.96	0.486	1.56	1.80	1.00	0.
1119.00	7788728.	7788728.	3640224.	73.68	0.465	1.56	1.00	1.00	0.
1125.00	8754384.	8754384.	4091543.	70.31	0.449	1.56	1.00	1.00	0.
1131.00	9722158.	9722158.	4543852.	67.40	0.423	1.56	1.00	1.00	0.
1137.50	11526835.	11526835.	5387306.	63.85	0.418	1.56	1.00	1.00	0.
1142.00	12732159.	12732159.	5950639.	61.59	0.416	1.56	1.00	1.00	0.
1153.00	15576904.	15576904.	7280190.	56.63	0.398	1.56	1.00	1.00	0.
1158.00	16831932.	16831932.	7866753.	54.58	0.391	1.56	1.80	1.00	0.
1169.00	19478703.	19478703.	9103777.	50.27	0.385	1.56	1.00	1.00	0.

1175.00	20823820,	20823820,	9732445,	47.92	0.395	1.56	1.00	1.00	0.
1181.50	22182720,	22182720,	10367555,	45.54	0.399	1.56	1.00	1.00	0.
1183.00	22483930,	22483930,	10508332,	44.74	0.400	1.56	1.00	1.00	0.
1192.00	24203608,	24203608,	11012096,	41.18	0.401	1.56	1.00	1.00	0.
1199.00	25425705,	25425705,	11883231,	38.42	0.412	1.56	1.00	1.00	0.
1202.00	25898498,	25898498,	12104173,	37.21	0.445	1.56	1.00	1.00	0.
1204.00	26178792,	26178792,	12235202,	36.39	0.493	1.56	1.00	1.00	0.
1205.00	26305897,	26305897,	12294989,	35.96	0.522	1.56	1.00	1.00	0.
1211.00	27016326,	27016326,	12626417,	33.45	0.519	1.56	1.00	1.00	0.
1221.00	28068842,	28068842,	13118956,	29.36	0.530	1.56	1.00	1.00	0.
1231.00	28945302,	28945302,	13528188,	25.34	0.548	1.56	1.00	1.00	0.
1246.00	30015136,	30015136,	14028198,	19.46	0.517	1.56	1.00	1.00	0.
1250.00	30191982,	30191982,	14110827,	17.90	0.681	1.56	1.00	1.00	0.
1253.00	32314893,	32314893,	15103009,	13.81	0.868	1.56	1.00	1.00	0.
1283.11	-1691,	-1691,	-790,	0.	0.	0.	1.00	1.00	0.

F = 8.972 LAMBDA = 0.467(14 16 0)

SOIL DATA

NO	WET	SAT	COH	FI	RU	EQ
1	135.0	135.0	0.	0.729	0.	0.018
2	135.0	135.0	0.	0.729	0.	0.020
3	135.0	135.0	0.	0.729	0.	0.020
4	135.0	135.0	0.	0.729	0.	0.020
5	135.0	135.0	0.	0.729	0.	0.030
6	135.0	135.0	0.	0.729	0.	0.030
7	135.0	135.0	0.	0.729	0.	0.040
8	135.0	135.0	0.	0.729	0.	0.050
9	135.0	135.0	0.	0.729	0.	0.068
10	135.0	135.0	0.	0.729	0.	0.080
11	135.0	135.0	0.	0.729	0.	0.098
12	135.0	135.0	0.	0.729	0.	0.120
13	135.0	135.0	0.	0.729	0.	0.150
14	135.0	135.0	0.	0.729	0.	0.180
15	135.0	135.0	0.	0.729	0.	0.240
16	135.0	135.0	0.	0.729	0.	0.300
17	135.0	135.0	0.	0.729	0.	0.360
18	135.0	135.0	0.	0.729	0.	0.480
19	135.0	135.0	0.	0.729	0.	0.600
20	135.0	135.0	0.	0.729	0.	0.900
21	135.0	135.0	0.	0.729	0.	1.200
22	135.0	135.0	0.	0.729	0.	1.800
23	135.0	135.0	0.	0.729	0.	3.000
24	135.0	135.0	0.	0.729	0.	4.500
25	135.0	135.0	0.	0.729	0.	6.000
26	135.0	135.0	0.	0.729	0.	9.000
27	135.0	135.0	0.	0.729	0.	15.000
28	135.0	135.0	0.	0.729	0.	0.

SURFACE NUMBER   2 ;   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT	X	Y	F(X)
	2 = 2	525.00	166.00	1.00
	5 = 5	975.00	463.00	1.00
	6 = 6	1250.00	488.00	1.00
	7 = 7	1285.00	469.50	1.00

NOT CONVERGING   0 =1

X-COORD;	E		X-FORCE	Y=YT	Y=YT/Y=Z	VERT F	SMALL F		PORE PRES
536.00	=327.	=327,	=98,	=0.43	=0.069	2.43	1.00	1.00	0.
553.79	=1970,	=1970,	=591,	=4.25	=0.241	1.00	1.00	1.00	0.
585.50	=8781,	=8781,	=2634,	=10.23	=0.270	2.43	1.00	1.00	0.
639.00	=27327,	=27327,	=8198,	=28.13	=0.392	2.43	1.00	1.00	0.
648.47	=28815,	=28815,	=8644,	=38.24	=0.492	2.43	1.00	1.00	0.
650.00	=29066,	=29066,	=8720,	=39.97	=0.508	2.43	1.00	1.00	0.
658.00	=30432,	=30432,	=9129,	=49.42	=0.590	2.43	1.00	1.00	0.
678.00	=34104,	=34104,	=10231,	=73.58	=0.809	2.43	1.00	1.00	0.
688.00	=36093,	=36093,	=10816,	=85.44	=0.903	2.43	1.00	1.00	0.
695.00	=37471,	=37471,	=11241,	=93.80	=0.955	2.43	1.00	1.00	0.
720.00	=31896,	=31896,	=9557,	=189.87	=1.670	2.43	1.00	1.00	0.
734.50	=28276,	=28276,	=6483,	=278.82	=2.338	2.43	1.00	1.00	0.
766.00	=2877,	=2877,	=863,	=4831.46	=35.773	2.43	1.00	1.00	0.
774.50	4472,	4472,	1342,	3538.39	25.702	2.43	1.00	1.00	0.
795.00	47101,	47101,	14154,	479.29	3.323	2.43	1.00	1.00	0.
816.00	93009,	93009,	27903,	328.52	2.175	2.43	1.00	1.00	0.
829.00	139459,	139459,	41838,	207.68	1.709	2.43	1.00	1.00	0.
833.00	154030,	154030,	46215,	296.67	1.630	2.43	1.00	1.00	0.
847.00	205759,	205759,	61725,	231.42	1.442	2.43	1.00	1.00	0.
850.00	220998,	220998,	66299,	225.00	1.402	2.43	1.00	1.00	0.
880.00	379074,	379074,	113722,	192.96	1.120	2.43	1.00	1.00	0.
890.00	463841,	463841,	139152,	182.27	1.030	2.43	1.00	1.00	0.
902.27	569219,	569219,	170766,	174.38	0.986	2.43	1.00	1.00	0.
905.00	592629,	592629,	177789,	173.12	0.979	2.43	1.00	1.00	0.
913.50	666231,	666231,	199869,	170.03	0.945	2.43	1.00	1.00	0.
930.00	862922,	862922,	258876,	162.24	0.880	2.43	1.00	1.00	0.
933.00	899211,	899211,	269763,	161.37	0.871	2.43	1.00	1.00	0.
947.00	1069964,	1069964,	320989,	158.67	0.846	2.43	1.00	1.00	0.
955.00	1232424,	1232424,	369727,	154.48	0.814	2.43	1.00	1.00	0.
975.00	1644475,	1644475,	493343,	149.13	0.773	2.43	1.00	1.00	0.
981.50	1682298,	1682298,	504678,	193.07	0.803	2.43	1.00	1.00	0.
996.00	1905680,	1905630,	571689,	154.00	0.833	2.43	1.00	1.00	0.
1007.00	2071278,	2071278,	621383,	193.97	0.845	2.43	1.00	1.00	0.
1014.00	2175393,	2175393,	652618,	193.74	0.852	2.43	1.00	1.00	0.
1016.50	2212333,	2212333,	663700,	193.62	0.855	2.43	1.00	1.00	0.
1035.00	2827146,	2827126,	848138,	142.27	0.797	2.43	1.00	1.00	0.
1046.00	3190313,	3190313,	957094,	137.17	0.773	2.43	1.00	1.00	0.
1072.00	4972513,	4972513,	1491754,	115.84	0.674	2.43	1.00	1.00	0.
1076.00	5240988,	5240988,	1572296,	113.81	0.668	2.43	1.00	1.00	0.
1095.50	7375259,	7375259,	2212578,	99.93	0.602	2.43	1.00	1.00	0.
1100.00	8051538,	8051538,	2415462,	96.81	0.589	2.43	1.00	1.00	0.
1112.50	9899073,	9899073,	2969722,	89.86	0.560	2.43	1.00	1.00	0.
1119.00	11378893,	11378893,	3413656,	85.73	0.541	2.43	1.00	1.00	0.
1125.00	12728259,	12728259,	3818478,	82.57	0.527	2.43	1.00	1.00	0.
1131.00	14080624,	14080624,	4224187,	79.90	0.502	2.43	1.00	1.00	0.
1137.50	16576229,	16576229,	4972869,	76.27	0.500	2.43	1.00	1.00	0.
1142.00	18243016,	18243016,	5472905,	74.05	0.500	2.43	1.00	1.00	0.
1153.00	22176882,	22176882,	6653065,	69.41	0.488	2.43	1.00	1.00	0.
1158.00	23912401,	23912401,	7173720,	67.58	0.484	2.43	1.00	1.00	0.
1169.00	27572499,	27572499,	8271750,	63.84	0.489	2.43	1.00	1.00	0.
1175.00	29432598,	29432598,	8829779,	61.86	0.510	2.43	1.00	1.00	0.

C94

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1181,58   31311758,  31311758,  9693527,    99,73    0,526    2,43    1,00    1,00       0,
1183,00   31728287,  31728287,  9918486,    99,24    0,929    2,43    1,00    1,00       0,
1192,00   34106461,  34106461,  10231938,   96,37    0,549    2,43    1,00    1,00       0,
1199,00   35796330,  35796330,  10738899,   54,19    0,580    2,43    1,00    1,00       0,
1202,00   36450051,  36450051,  10935015,   53,25    0,637    2,43    1,00    1,00       0,
1204,00   36837739,  36837739,  110913227,  52,61    0,713    2,43    1,00    1,00       0,
1205,00   37013493,  37013493,  1110403A,   52,29    0,759    2,43    1,00    1,00       0,
1211,00   37996704,  37996704,  11899011,   50,41    0,782    2,43    1,00    1,00       0,
1221,00   39458094,  39458094,  11037416,   47,40    0,856    2,43    1,00    1,00       0,
1231,00   40681820,  40681820,  12204946,   44,55    0,963    2,43    1,00    1,00       0,
1246,00   42181442,  42181442,  12654433,   40,50    1,076    2,43    1,00    1,00       0,
1250,00   42448631,  42448631,  127369897,  39,48    1,502    2,43    1,00    1,00       0,
1253,00   42690086,  42690086,  12807026,   36,80    2,312    2,43    1,00    1,00       0,
1283,11   41073004,  41073004,  12821901,   0,       0,       0,      1,00    1,00       0,
F =   0,836  LAMBDA =   0,300(   0  20    0)
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                            SOIL DATA

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NO    WET     SAT     CON     FI      RU      EQ
 1   135,0   135,0   0,     0,729   0,     0,020
 2   135,0   135,0   0,     0,729   0,     0,020
 3   135,0   135,0   0,     0,729   0,     0,030
 4   135,0   135,0   0,     0,729   0,     0,030
 5   135,0   135,0   0,     0,729   0,     0,040
 6   135,0   135,0   0,     0,729   0,     0,040
 7   135,0   135,0   0,     0,729   0,     0,050
 8   135,0   135,0   0,     0,729   0,     0,060
 9   135,0   135,0   0,     0,729   0,     0,080
10   135,0   135,0   0,     0,729   0,     0,100
11   135,0   135,0   0,     0,729   0,     0,120
12   135,0   135,0   0,     0,729   0,     0,160
13   135,0   135,0   0,     0,729   0,     0,200
14   135,0   135,0   0,     0,729   0,     0,240
15   135,0   135,0   0,     0,729   0,     0,320
16   135,0   135,0   0,     0,729   0,     0,400
17   135,0   135,0   0,     0,729   0,     0,480
18   135,0   135,0   0,     0,729   0,     0,640
19   135,0   135,0   0,     0,729   0,     0,800
20   135,0   135,0   0,     0,729   0,     1,200
21   135,0   135,0   0,     0,729   0,     1,600
22   135,0   135,0   0,     0,729   0,     2,400
23   135,0   135,0   0,     0,729   0,     4,000
24   135,0   135,0   0,     0,729   0,     6,000
25   135,0   135,0   0,     0,729   0,     8,000
26   135,0   135,0   0,     0,729   0,     12,000
27   135,0   135,0   0,     0,729   0,     20,000
28   135,0   135,0   0,     0,729   0,     0,
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C95

SURFACE NUMBER   2 ; 1 (SPECIFIED)

SURFACE DEFINED BY#	POINT		X	Y	F(X)
2-	2		525,00	166,00	1,00
5-	5		975,00	463,00	1,00
6-	6		1250,00	488,00	1,00
7-	7		1285,00	469,50	1,00

NOT CONVERGING   0 -1

X-COORD,	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
936,00	-395,	-395,	-118,	-0,56	-0,089	2,43	1,00	1,00	0,
553,79	-2492,	-2492,	-748,	-4,19	=0,237	2,43	1,00	1,00	0,
589,58	-11184,	-11184,	-3359,	-9,93	=0,262	2,43	1,00	1,00	0,
639,00	-31781,	-31781,	-9534,	-33,41	=0,466	2,43	1,00	1,00	0,
648,47	-32723,	-32723,	-9817,	-46,56	=0,599	2,43	1,00	1,00	0,
650,00	-32882,	-32882,	-9865,	-48,86	=0,621	2,43	1,00	1,00	0,
658,00	-33749,	-33749,	-10124,	-61,67	=0,736	2,43	1,00	1,00	0,
678,00	-36075,	-36075,	-10822,	-96,47	=1,060	2,43	1,00	1,00	0,
685,00	-37310,	-37310,	-11193,	-114,66	=1,212	2,43	1,00	1,00	0,
695,00	-38209,	-38209,	-11463,	-127,86	=1,302	2,43	1,00	1,00	0,
720,00	-26667,	-26667,	-8000,	-314,52	=2,766	2,43	1,00	1,00	0,
734,50	-19307,	-19307,	-5792,	-569,80	=4,744	2,43	1,00	1,00	0,
766,00	20937,	20937,	6281,	916,62	6,787	2,43	1,00	1,00	0,
774,50	32582,	32582,	9774,	670,12	4,868	2,43	1,00	1,00	0,
799,00	94481,	94481,	28344,	329,14	2,283	2,43	1,00	1,00	0,
816,00	160902,	160902,	48271,	260,71	1,726	2,43	1,00	1,00	0,
829,00	226909,	226909,	67953,	225,88	1,442	2,43	1,00	1,00	0,
833,00	247119,	247119,	74136,	219,20	1,392	2,43	1,00	1,00	0,
847,00	320143,	320143,	96043,	283,52	1,268	2,43	1,00	1,00	0,
850,00	341417,	341417,	102425,	199,22	1,241	2,43	1,00	1,00	0,
800,00	561960,	561960,	168590,	177,60	1,031	2,43	1,00	1,00	0,
890,00	678840,	678840,	203652,	169,71	0,959	2,43	1,00	1,00	0,
902,27	824130,	824130,	247239,	163,95	0,927	2,43	1,00	1,00	0,
905,00	856408,	856408,	256922,	163,03	0,922	2,43	1,00	1,00	0,
913,50	957885,	957885,	287306,	160,85	0,894	2,43	1,00	1,00	0,
930,00	1227504,	1227504,	368251,	154,90	0,840	2,43	1,00	1,00	0,
933,00	1277240,	1277240,	883174,	154,26	0,833	2,43	1,00	1,00	0,
947,00	1511311,	1511311,	453393,	152,40	0,813	2,43	1,00	1,00	0,
959,00	1732947,	1732947,	519764,	148,99	0,785	2,43	1,00	1,00	0,
975,00	2293670,	2293670,	688101,	144,70	0,750	2,43	1,00	1,00	0,
981,50	2386922,	2386922,	715957,	149,85	0,765	2,43	1,00	1,00	0,
996,00	2780966,	2780966,	834290,	142,20	0,769	2,43	1,00	1,00	0,
1007,00	3073676,	3073676,	922043,	139,49	0,766	2,43	1,00	1,00	0,
1014,00	3257331,	3257331,	977199,	137,83	0,764	2,43	1,00	1,00	0,
1010,50	3322963,	3322963,	996769,	137,24	0,763	2,43	1,00	1,00	0,
1035,00	4269292,	4269292,	1280768,	125,89	0,705	2,43	1,00	1,00	0,
1046,00	4828569,	4828569,	1448571,	120,83	0,681	2,43	1,00	1,00	0,
1072,00	7404648,	7404648,	2221394,	103,21	0,601	2,43	1,00	1,00	0,
1076,00	7792715,	7792715,	2337819,	101,31	0,595	2,43	1,00	1,00	0,
1095,50	10803893,	10803893,	3241768,	90,19	0,543	2,43	1,00	1,00	0,
1100,00	11750855,	11750855,	3525257,	87,68	0,533	2,43	1,00	1,00	0,
1112,50	14332405,	14332405,	4299722,	81,93	0,510	2,43	1,00	1,00	0,
1119,00	16380499,	16380499,	4914150,	78,59	0,496	2,43	1,00	1,00	0,
1129,00	18248149,	18248149,	5474445,	75,97	0,485	2,43	1,00	1,00	0,
1131,00	20119894,	20119894,	6035968,	73,73	0,463	2,43	1,00	1,00	0,
1137,50	23549519,	23549519,	7064856,	70,79	0,464	2,43	1,00	1,00	0,
1142,00	25840126,	25840126,	7752038,	68,94	0,465	2,43	1,00	1,00	0,
1153,00	31246304,	31246304,	9373891,	64,93	0,456	2,43	1,00	1,00	0,
1158,00	33631369,	33631369,	10089411,	63,31	0,453	2,43	1,00	1,00	0,
1169,00	38661316,	38661316,	11598395,	59,94	0,459	2,43	1,00	1,00	0,
1175,00	41217586,	41217586,	12365276,	58,12	0,480	2,43	1,00	1,00	0,

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1181.50    43800052.   43800052.   13140016.     56.14      0.494     2.43     1.00     1.00            0.
1183.00    44372473.   44372473.   13811742.     55.08      0.498     2.43     1.00     1.00            0.
1192.00    47640716.   47640716.   14292215.     52.98      0.516     2.43     1.00     1.00            0.
1199.00    49963046.   49963046.   14988914.     50.91      0.545     2.43     1.00     1.00            0.
1202.00    50861432.   50861432.   15258430.     50.01      0.598     2.43     1.00     1.00            0.
1204.00    51394219.   51394219.   15418266.     49.41      0.669     2.43     1.00     1.00            0.
1205.00    51635696.   51635696.   15490709.     49.10      0.713     2.43     1.00     1.00            0.
1211.00    52987540.   52987540.   15896202.     47.29      0.734     2.43     1.00     1.00            0.
1221.00    55000297.   55000297.   16500077.     44.58      0.802     2.43     1.00     1.00            0.
1231.00    56690904.   56690904.   17007271.     41.60      0.899     2.43     1.00     1.00            0.
1246.00    58767508.   58767508.   17630253.     37.64      1.000     2.43     1.00     1.00            0.
1250.00    59150830.   59150830.   17745249.     36.64      1.394     2.43     1.00     1.00            0.
1253.00    59827921.   59827921.   17948376.     33.77      2.122     2.43     1.00     1.00            0.
1283.11    56879895.   56879895.   17063957.      0.        0.        0.       1.00     1.00            0.
F =    0./81   LAMBDA =    0.300(   0  20   0)
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SOIL DATA

NO	WET	SAT	CON	FI	RU	EQ
1	135.0	135.0	0.	0.729	0.	0.030
2	135.0	135.0	0.	0.729	0.	0.030
3	135.0	135.0	0.	0.729	0.	0.040
4	135.0	135.0	0.	0.729	0.	0.040
5	135.0	135.0	0.	0.729	0.	0.050
6	135.0	135.0	0.	0.729	0.	0.050
7	135.0	135.0	0.	0.729	0.	0.060
8	135.0	135.0	0.	0.729	0.	0.080
9	135.0	135.0	0.	0.729	0.	0.100
10	135.0	135.0	0.	0.729	0.	0.130
11	135.0	135.0	0.	0.729	0.	0.150
12	135.0	135.0	0.	0.729	0.	0.200
13	135.0	135.0	0.	0.729	0.	0.250
14	135.0	135.0	0.	0.729	0.	0.300
15	135.0	135.0	0.	0.729	0.	0.400
16	135.0	135.0	0.	0.729	0.	0.500
17	135.0	135.0	0.	0.729	0.	0.600
18	135.0	135.0	0.	0.729	0.	0.800
19	135.0	135.0	0.	0.729	0.	1.000
20	135.0	135.0	0.	0.729	0.	1.500
21	135.0	135.0	0.	0.729	0.	2.000
22	135.0	135.0	0.	0.729	0.	3.000
23	135.0	135.0	0.	0.729	0.	5.000
24	135.0	135.0	0.	0.729	0.	7.500
25	135.0	135.0	0.	0.729	0.	10.000
26	135.0	135.0	0.	0.729	0.	15.000
27	135.0	135.0	0.	0.729	0.	25.000
28	135.0	135.0	0.	0.729	0.	0.

SURFACE NUMBER   2 #   1 (SPECIFIED)

SURFACE DEFINED BY#	POINT		X	Y	F(X)
	2=	2	525.00	160.00	1.00
	5=	5	975.00	465.00	1.00
	6=	6	1250.00	488.00	1.00
	7=	7	1285.00	469.50	1.00

NOT CONVERGING   0 =1

X-COORD	E		X-FORCE	Y=YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
536.00	-381.	-381.	-114.	=1.12	=0.179	2.43	1.00	1.00	0.
553.70	-2074.	-2074.	-622.	=8.40	=0.476	2.43	1.00	1.00	0.
589.50	-9092.	=9092.	-2728.	=20.12	=0.530	2.43	1.80	1.00	0.
639.00	-24071.	-24071.	-7221.	=64.75	=0.903	2.43	1.00	1.00	0.
648.47	-22625.	-22625.	-6788.	=96.96	=1.247	2.43	1.00	1.00	0.
650.00	-22381.	-22381.	-6714.	=103.10	=1.310	2.43	1.00	1.00	0.
658.00	-21053.	-21053.	-6316.	=140.50	=1.677	2.43	1.00	1.00	0.
678.00	-17484.	=17484.	-5245.	=279.22	=3.069	2.43	1.00	1.00	0.
688.70	=15989.	=15989.	=4877.	=383.89	=4.059	2.43	1.00	1.00	0.
695.00	=14211.	=14211.	=4263.	=480.27	=4.891	2.43	1.00	1.00	0.
720.00	10133.	10133.	3040.	1139.70	10.024	2.43	1.00	1.00	0.
734.50	25656.	25656.	7697.	583.18	4.690	2.43	1.00	1.00	0.
766.00	91105.	91105.	27331.	284.78	2.109	2.43	1.00	1.00	0.
774.50	110043.	110043.	33013.	267.65	1.944	2.43	1.00	1.00	0.
795.00	198554.	198554.	59506.	209.44	1.492	2.43	1.80	1.00	0.
816.00	293531.	293531.	86059.	190.11	1.258	2.43	1.00	1.00	0.
829.00	383397.	383397.	115019.	176.77	1.128	2.43	1.00	1.00	0.
833.00	411627.	411627.	123488.	174.12	1.106	2.43	1.00	1.00	0.
847.00	511695.	511695.	153496.	167.98	1.046	2.43	1.00	1.00	0.
850.00	540173.	540173.	162052.	165.96	1.034	2.43	1.00	1.00	0.
880.00	835842.	835842.	250753.	156.39	0.908	2.43	1.00	1.00	0.
890.00	989178.	989178.	296753.	152.11	0.860	2.43	1.00	1.00	0.
902.27	1179799.	1179799.	353940.	149.16	0.844	2.43	1.00	1.00	0.
905.00	1222147.	1222147.	366644.	148.73	0.841	2.43	1.00	1.00	0.
913.50	1355286.	1355286.	406586.	147.80	0.822	2.43	1.00	1.00	0.
930.00	1705228.	1705228.	511568.	144.47	0.783	2.43	1.00	1.00	0.
933.00	1769792.	1769792.	530938.	144.17	0.778	2.43	1.80	1.00	0.
947.00	2073587.	2073587.	622076.	143.56	0.766	2.43	1.00	1.00	0.
955.00	2357177.	2357177.	707153.	141.22	0.744	2.43	1.00	1.00	0.
975.00	3076447.	3076447.	922934.	138.68	0.719	2.43	1.00	1.00	0.
981.50	3231041.	3231041.	969312.	138.21	0.725	2.43	1.00	1.00	0.
996.00	3810669.	3810669.	1143201.	132.49	0.717	2.43	1.00	1.00	0.
1007.00	4240907.	4240907.	1272192.	128.67	0.706	2.43	1.80	1.00	0.
1014.00	4510679.	4510679.	1353204.	126.43	0.701	2.43	1.00	1.00	0.
1016.50	4606536.	4606536.	1381961.	125.66	0.699	2.43	1.00	1.00	0.
1035.00	5901253.	5901253.	1770376.	115.01	0.644	2.43	1.00	1.00	0.
1046.00	6666104.	6666104.	1999831.	110.23	0.621	2.43	1.00	1.00	0.
1072.00	10054980.	10054980.	3016494.	95.17	0.554	2.43	1.00	1.00	0.
1076.00	10565490.	10565490.	3169647.	93.49	0.549	2.43	1.00	1.00	0.
1095.50	14468452.	14468452.	4340536.	84.02	0.506	2.43	1.00	1.00	0.
1100.00	15683934.	15683934.	4705180.	81.88	0.498	2.43	1.00	1.00	0.
1112.50	19004519.	19004518.	5701356.	76.90	0.479	2.43	1.00	1.00	0.
1119.00	21621782.	21621732.	6486519.	74.06	0.467	2.43	1.00	1.00	0.
1125.00	24008359.	24008359.	7202508.	71.79	0.458	2.43	1.00	1.00	0.
1131.00	26400220.	26400220.	7920066.	69.83	0.439	2.43	1.00	1.00	0.
1137.50	30761215.	30761215.	9228365.	67.33	0.441	2.43	1.00	1.00	0.
1142.00	33673875.	33673875.	10102163.	65.71	0.443	2.43	1.00	1.00	0.
1153.00	40548190.	40548190.	12164457.	62.13	0.437	2.43	1.00	1.00	0.
1156.00	43580957.	43580957.	13074287.	60.64	0.434	2.43	1.00	1.00	0.
1169.00	49976869.	49976869.	14993061.	57.51	0.440	2.43	1.00	1.00	0.
1175.00	53227337.	53227337.	15968201.	55.80	0.460	2.43	1.00	1.00	0.

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1181.50   56511114,  56511114,  16953334,        53.91       0.474      2.43      1.00      1.00           0.
1185.00   57230900,  57230900,  17171696;        93.48       0.478      2.43      1.00      1.00           0.
1192.00   61394774,  61394774,  18418432,        99.89       0.495      2.43      1.00      1.00           0.
1199.00   64347771,  64347771,  19304331,        48.89       0.524      2.43      1.00      1.00           0.
1202.00   65490149,  65490129,  19647039,        48.02       0.574      2.43      1.00      1.00           0.
1204.00   66167603,  66167603,  19850281;        47.43       0.643      2.43      1.00      1.00           0.
1205.00   66474656,  66474656,  19942397,        47.13       0.684      2.43      1.00      1.00           0.
1211.00   68194090,  68194090,  20458229?        49.38       0.704      2.43      1.00      1.00           0.
1221.00   70756968,  70756968,  21227091,        42.52       0.768      2.43      1.00      1.00           0.
1231.00   72913873,  72913873,  21874102,        39.79       0.860      2.43      1.00      1.00           0.
1246.00   75567276,  75567276,  22670183,        35.89       0.954      2.43      1.00      1.00           0.
1250.00   76067228,  76067228,  22820169,        34.90       1.328      2.43      1.00      1.00           0.
1253.00   77562821,  77562821,  23268846,        31.79       1.997      2.43      1.00      1.00           0.
1283.11   72799830,  72799830,  21839951;        0.          0.         0.        1.00      1.00           0.
F =    0.757   LAMBDA =   0.300(   0   20    0)
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SOIL DATA

NO	WET	SAT	CON	FI	RU	EQ
1	135.0	135.0	0.	0.729	0.	0.030
2	135.0	135.0	0.	0.729	0.	0.040
3	135.0	135.0	0.	0.729	0.	0.040
4	135.0	135.0	0.	0.729	0.	0.050
5	135.0	135.0	0.	0.729	0.	0.050
6	135.0	135.0	0.	0.729	0.	0.060
7	135.0	135.0	0.	0.729	0.	0.080
8	135.0	135.0	0.	0.729	0.	0.090
9	135.0	135.0	0.	0.729	0.	0.120
10	135.0	135.0	0.	0.729	0.	0.150
11	135.0	135.0	0.	0.729	0.	0.180
12	135.0	135.0	0.	0.729	0.	0.240
13	135.0	135.0	0.	0.729	0.	0.300
14	135.0	135.0	0.	0.729	0.	0.360
15	135.0	135.0	0.	0.729	0.	0.480
16	135.0	135.0	0.	0.729	0.	0.600
17	135.0	135.0	0.	0.729	0.	0.720
18	135.0	135.0	0.	0.729	0.	0.960
19	135.0	135.0	0.	0.729	0.	1.200
20	135.0	135.0	0.	0.729	0.	1.800
21	135.0	135.0	0.	0.729	0.	2.400
22	135.0	135.0	0.	0.729	0.	3.600
23	135.0	135.0	0.	0.729	0.	6.000
24	135.0	135.0	0.	0.729	0.	9.000
25	135.0	135.0	0.	0.729	0.	12.000
26	135.0	135.0	0.	0.729	0.	18.000
27	135.0	135.0	0.	0.729	0.	30.000
28	135.0	135.0	0.	0.729	0.	0.

SURFACE NUMBER   2 ; 1 (SPECIFIED)

SURFACE DEFINED BY#   POINT

		X	Y	F(x)
2-	2	525.00	166.80	1.00
5-	5	975.00	463.00	1.00
6-	6	1250.00	488.00	1.00
7-	7	1285.00	469.50	1.00

NOT CONVERGING   0 -1

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
536.00	-813.	-813.	-244.	-0.11	-0.018	2.43	1.00	1.00	0.
553.79	-5461.	-5431.	-1629.	-1.86	-0.105	2.43	1.00	1.00	0.
585.50	-24975.	-24975.	-7372.	-4.52	-0.119	2.43	1.00	1.00	0.
639.08	-75270.	-75270.	-22581.	-16.16	-0.225	2.43	1.00	1.00	0.
648.47	-81209.	-81209.	-24363.	-22.25	-0.286	2.43	1.80	1.00	0.
650.00	-82212.	-82212.	-24664.	-23.27	-0.296	2.43	1.00	1.00	0.
658.00	-87665.	-87665.	-26300.	-28.80	-0.344	2.43	1.00	1.00	0.
678.00	-102326.	-102326.	-30698.	-42.18	-0.464	2.43	1.00	1.00	0.
688.00	-110110.	-110110.	-33033.	-48.40	-0.512	2.43	1.80	1.00	0.
695.00	-115771.	-115771.	-34731.	-52.67	-0.536	2.43	1.00	1.00	0.
720.00	-114441.	-114441.	-34332.	-93.98	-0.827	2.43	1.00	1.00	0.
734.50	-113594.	-113594.	-34078.	-124.52	-1.044	2.43	1.00	1.00	0.
766.08	-75968.	-75968.	-22791.	-335.13	-2.481	2.43	1.00	1.00	0.
774.50	-65081.	-65081.	-19524.	-446.90	-3.246	2.43	1.00	1.00	0.
795.00	13433.	13433.	4030.	3133.08	21.727	2.43	1.00	1.00	0.
816.00	97683.	97683.	29305.	586.96	3.886	2.43	1.00	1.00	0.
829.00	187600.	187600.	56280.	375.62	2.398	2.43	1.00	1.00	0.
833.00	215847.	215847.	64754.	346.33	2.199	2.43	1.00	1.00	0.
847.00	315929.	315929.	94779.	286.23	1.783	2.43	1.00	1.00	0.
850.00	346141.	346141.	103842.	273.13	1.702	2.43	1.00	1.00	0.
880.00	659389.	659339.	197802.	212.85	1.235	2.43	1.00	1.00	0.
890.00	830979.	830979.	249294.	195.89	1.107	2.43	1.00	1.00	0.
902.27	1044394.	1044354.	313306.	183.65	1.039	2.43	1.00	1.00	0.
905.00	1091757.	1091757.	327527.	181.70	1.028	2.43	1.00	1.00	0.
913.50	1240788.	1240788.	372236.	176.87	0.983	2.43	1.00	1.00	0.
930.00	1643200.	1643200.	492960.	165.76	0.899	2.43	1.00	1.00	0.
933.00	1717444.	1717444.	515233.	164.49	0.888	2.43	1.00	1.00	0.
947.00	2066790.	2066790.	620037.	160.36	0.855	2.43	1.80	1.00	0.
955.00	2403029.	2403029.	720909.	199.00	0.817	2.43	1.00	1.00	0.
975.00	3255835.	3255835.	976750.	148.00	0.767	2.43	1.00	1.00	0.
981.50	3449538.	3449538.	1034861.	146.79	0.770	2.43	1.00	1.00	0.
996.00	4186387.	4186387.	1255916.	137.97	0.746	2.43	1.00	1.00	0.
1007.00	4732814.	4732814.	1419844.	132.55	0.728	2.43	1.00	1.00	0.
1014.00	5076265.	5076265.	1522881.	129.51	0.718	2.43	1.00	1.00	0.
1016.50	5198129.	5198129.	1559438.	128.48	0.715	2.43	1.00	1.00	0.
1035.00	6859032.	6859032.	2057709.	115.00	0.644	2.43	1.00	1.00	0.
1046.08	7840207.	7840207.	2352062.	109.25	0.616	2.43	1.00	1.00	0.
1072.00	12209977.	12209977.	3662993.	91.98	0.535	2.43	1.00	1.00	0.
1076.00	12860291.	12860291.	3860475.	90.15	0.530	2.43	1.00	1.00	0.
1095.50	17911491.	17911491.	5873447.	79.94	0.482	2.43	1.00	1.00	0.
1100.00	19483589.	19483589.	5845077.	77.69	0.473	2.43	1.00	1.00	0.
1112.50	23778415.	23778415.	7133524.	72.51	0.452	2.43	1.00	1.00	0.
1119.00	27166561.	27166561.	8149968.	69.59	0.439	2.43	1.00	1.00	0.
1125.00	30256199.	30256199.	9076860.	67.28	0.430	2.43	1.00	1.00	0.
1131.00	33392612.	33392612.	10005784.	65.28	0.410	2.43	1.00	1.00	0.
1137.50	39002064.	39002064.	11700619.	62.77	0.411	2.43	1.00	1.00	0.
1142.00	42775270.	42775270.	12832581.	61.16	0.413	2.43	1.00	1.00	0.
1153.00	51680601.	51680601.	15504180.	57.61	0.405	2.43	1.00	1.00	0.
1158.00	55609400.	55609400.	16082820.	56.15	0.402	2.43	1.00	1.00	0.
1169.00	63894984.	63894984.	19168495.	53.08	0.406	2.43	1.00	1.00	0.
1175.00	68105803.	68105803.	20431741.	51.42	0.424	2.43	1.00	1.00	0.

C100

1181.50	72359772,	72359772,	21307932,	49.58	0.436	2.43	1.00	1.00	0.
1183.00	73302693,	73302693,	21990808,	49.16	0.439	2.43	1.00	1.00	0.
1192.00	78686308,	78686308,	23605893,	46.65	0.454	2.43	1.00	1.00	0.
1199.00	82511769,	82511769,	24753531,	44.71	0.479	2.43	1.00	1.00	0.
1202.00	83991636,	83991636,	25197491,	43.86	0.524	2.43	1.00	1.00	0.
1204.00	84869270,	84869270,	25460781,	43.29	0.586	2.43	1.00	1.00	0.
1205.00	85267043,	85267043,	25580113,	43.00	0.624	2.43	1.00	1.00	0.
1211.00	87494674,	87494674,	26248402,	41.29	0.641	2.43	1.00	1.00	0.
1221.00	90816253,	90816253,	27244876,	38.52	0.696	2.43	1.00	1.00	0.
1231.00	93613429,	93613429,	28084029,	35.86	0.775	2.43	1.00	1.00	0.
1246.00	97054913,	97054913,	29116474,	32.05	0.852	2.43	1.00	1.00	0.
1250.00	97710606,	97710606,	29313182,	31.08	1.182	2.43	1.00	1.00	0.

F = 0.013 LAMBDA = 0.300(0 20 0)

SOIL DATA

NO	WET	SAT	COM	FI	RU	EQ
1	135.0	135.0	0.	0.729	0.	0.048
2	135.0	135.0	0.	0.729	0.	0.048
3	135.0	135.0	0.	0.729	0.	0.050
4	135.0	135.0	0.	0.729	0.	0.068
5	135.0	135.0	0.	0.729	0.	0.068
6	135.0	135.0	0.	0.729	0.	0.078
7	135.0	135.0	0.	0.729	0.	0.090
8	135.0	135.0	0.	0.729	0.	0.110
9	135.0	135.0	0.	0.729	0.	0.146
10	135.0	135.0	0.	0.729	0.	0.186
11	135.0	135.0	0.	0.729	0.	0.218
12	135.0	135.0	0.	0.729	0.	0.286
13	135.0	135.0	0.	0.729	0.	0.358
14	135.0	135.0	0.	0.729	0.	0.428
15	135.0	135.0	0.	0.729	0.	0.560
16	135.0	135.0	0.	0.729	0.	0.708
17	135.0	135.0	0.	0.729	0.	0.848
18	135.0	135.0	0.	0.729	0.	1.128
19	135.0	135.0	0.	0.729	0.	1.400
20	135.0	135.0	0.	0.729	0.	2.108
21	135.0	135.0	0.	0.729	0.	2.800
22	135.0	135.0	0.	0.729	0.	4.200
23	135.0	135.0	0.	0.729	0.	7.000
24	135.0	135.0	0.	0.729	0.	10.500
25	135.0	135.0	0.	0.729	0.	14.000
26	135.0	135.0	0.	0.729	0.	21.000
27	135.0	135.0	0.	0.729	0.	35.000
28	135.0	135.0	0.	0.729	0.	0.

SURFACE NUMBER   2 ; 1 (SPECIFIED)

SURFACE DEFINED BY#	POINT	X	Y	F(x)
	2- 2	525,00	166,00	1,00
	5- 5	975,00	463,00	1,00
	8- 8	1250,00	488,00	1,00
	7- 7	1285,00	469,50	1,00

NOT CONVERGING   0 -1

X-COORD.	E		X-FORCE	Y=YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
936,00	56,	56,	17,	21,83	3,487	2,43	1,00	1,00	0,
553,79	1634,	1634,	490,	23,89	1,354	2,43	1,00	1,00	0,
989,59	8172,	8172,	2452,	49,08	1,294	2,43	1,00	1,00	0,
639,00	42296,	42296,	12689,	75,80	1,057	2,43	1,00	1,00	0,
848,47	57484,	57484,	17245,	76,13	0,979	2,43	1,00	1,00	0,
650,00	60090,	60090,	18015,	76,36	0,970	2,43	1,00	1,00	0,
658,00	73996,	73996,	22199,	78,07	0,932	2,43	1,00	1,00	0,
678,00	111493,	111493,	33448,	83,69	0,920	2,43	1,00	1,00	0,
688,00	131400,	131400,	39420,	86,72	0,917	2,43	1,00	1,00	0,
695,00	145877,	145877,	43763,	88,93	0,906	2,43	1,00	1,00	0,
720,00	228733,	228733,	68620,	93,08	0,819	2,43	1,00	1,00	0,
734,59	281568,	281568,	84470,	96,86	0,812	2,43	1,00	1,00	0,
766,00	446224,	446224,	133867,	102,72	0,761	2,43	1,00	1,00	0,
774,59	493870,	493870,	148161,	104,80	0,761	2,43	1,00	1,00	0,
795,09	669402,	669402,	200820,	106,72	0,740	2,43	1,00	1,00	0,
816,00	857756,	857756,	257327,	110,18	0,729	2,43	1,00	1,00	0,
829,00	1018569,	1018569,	305571,	111,37	0,711	2,43	1,00	1,00	0,
833,00	1069086,	1069086,	320726,	111,88	0,710	2,43	1,80	1,00	0,
847,00	1248079,	1248079,	374424,	113,91	0,710	2,43	1,00	1,00	0,
850,00	1296258,	1296258,	386877,	114,12	0,711	2,43	1,00	1,00	0,
880,00	1795726,	1795726,	538718,	117,90	0,684	2,43	1,00	1,00	0,
890,00	2039036,	2039036,	611711,	118,52	0,670	2,43	1,00	1,00	0,
902,27	2341507,	2341507,	702452,	119,73	0,677	2,43	1,00	1,00	0,
905,00	2408704,	2408704,	722611,	120,04	0,679	2,43	1,00	1,00	0,
913,59	2619965,	2619965,	785989,	121,10	0,673	2,43	1,00	1,00	0,
930,00	3156991,	3156991,	947097,	122,32	0,663	2,43	1,00	1,00	0,
933,09	3256071,	3256071,	976821,	122,64	0,662	2,43	1,00	1,00	0,
947,00	3722280,	3722280,	1116684,	124,35	0,663	2,43	1,00	1,00	0,
955,00	4140197,	4140197,	1242059,	124,28	0,655	2,43	1,00	1,00	0,
975,00	5200163,	5200163,	1560049,	125,39	0,650	2,43	1,00	1,00	0,
981,59	5497150,	5497150,	1649145,	123,46	0,648	2,43	1,00	1,00	0,
996,00	6472906,	6472906,	1941872,	116,97	0,633	2,43	1,00	1,00	0,
1007,00	7196502,	7196502,	2158951,	112,75	0,619	2,43	1,00	1,00	0,
1014,00	7651314,	7651314,	2295394,	110,31	0,611	2,43	1,00	1,00	0,
1016,59	7812680,	7812680,	2343804,	109,48	0,609	2,43	1,00	1,00	0,
1035,00	9796918,	9796918,	2939075,	101,00	0,566	2,43	1,00	1,00	0,
1046,00	10969099,	10969099,	3290730,	97,04	0,547	2,43	1,00	1,00	0,
1072,00	15871095,	15871095,	4761329,	86,07	0,501	2,43	1,00	1,00	0,
1076,00	16609545,	16609545,	4982664,	84,75	0,498	2,43	1,00	1,00	0,
1095,50	22117398,	22117398,	6635220,	77,73	0,468	2,43	1,00	1,00	0,
1100,00	23813104,	23813104,	7143931,	76,16	0,463	2,43	1,00	1,00	0,
1112,59	28445616,	28445616,	8533685,	72,31	0,451	2,43	1,00	1,00	0,
1119,09	32057085,	32057085,	9617126,	70,19	0,443	2,43	1,00	1,00	0,
1125,00	35350372,	35350372,	10605112,	68,43	0,437	2,43	1,00	1,00	0,
1131,00	38650879,	38650879,	11595264,	66,87	0,420	2,43	1,00	1,00	0,
1137,59	44618193,	44618193,	13385458,	65,03	0,426	2,43	1,00	1,00	0,
1142,00	48603695,	48603695,	14581108,	63,75	0,430	2,43	1,00	1,00	0,
1153,00	58010078,	58010078,	17403023,	60,75	0,427	2,43	1,00	1,00	0,
1158,00	62159928,	62159928,	18647978,	59,46	0,426	2,43	1,00	1,00	0,
1169,00	70911694,	70911694,	21273508,	56,65	0,434	2,43	1,00	1,00	0,
1175,00	75359431,	75359431,	22607829,	55,08	0,454	2,43	1,00	1,00	0,

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1181.58   79852746,  79852746,  23955824,    53.31    0.469    2.43    1.00    1.00         0.
1103.00   80848720,  80848720,  24254616,    52.70    0.473    2.43    1.00    1.00         0.
1192.00   86535241,  86535241,  25960572,    50.43    0.491    2.43    1.00    1.00         0.
1199.00   90575939,  90575939,  27172782,    48.51    0.520    2.43    1.00    1.00         0.
1202.00   92139070,  92139070,  27641721,    47.66    0.570    2.43    1.00    1.00         0.
1204.00   93066083,  93066083,  27919825,    47.09    0.838    2.43    1.00    1.00         0.
1205.00   93486237,  93486237,  28045871,    46.80    0.679    2.43    1.00    1.00         0.
1211.00   95839931,  95839931,  28751979,    45.07    0.699    2.43    1.00    1.00         0.
1221.00   99353485,  99353485,  29806046,    42.27    0.763    2.43    1.00    1.00         0.
1231.00  102318218, 102318218,  30695466,    39.57    0.855    2.43    1.00    1.00         0.
1246.00  105974065, 105974065,  31792220,    35.71    0.949    2.43    1.00    1.00         0.
1250.00  106679917, 106679917,  32003859,    34.72    1.321    2.43    1.00    1.00         0.
1253.00  107627945, 107627945,  32288384,    31.96    2.008    2.43    1.00    1.00         0.
1203.11  106163997, 106163997,  31849199,     0.      0.       0.      1.00    1.00         0.
F = 0.949  LAMBDA = 0.300(  0  20   0)
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                    SOIL DATA

NO    WET     SAT     CON    FI      RU    EQ
 1   135.0   135.0    0.    0.729    0.    0.040
 2   135.0   135.0    0.    0.729    0.    0.050
 3   135.0   135.0    0.    0.729    0.    0.060
 4   135.0   135.0    0.    0.729    0.    0.060
 5   135.0   135.0    0.    0.729    0.    0.070
 6   135.0   135.0    0.    0.729    0.    0.080
 7   135.0   135.0    0.    0.729    0.    0.100
 8   135.0   135.0    0.    0.729    0.    0.120
 9   135.0   135.0    0.    0.729    0.    0.160
10   135.0   135.0    0.    0.729    0.    0.200
11   135.0   135.0    0.    0.729    0.    0.240
12   135.0   135.0    0.    0.729    0.    0.320
13   135.0   135.0    0.    0.729    0.    0.400
14   135.0   135.0    0.    0.729    0.    0.480
15   135.0   135.0    0.    0.729    0.    0.640
16   135.0   135.0    0.    0.729    0.    0.800
17   135.0   135.0    0.    0.729    0.    0.960
18   135.0   135.0    0.    0.729    0.    1.280
19   135.0   135.0    0.    0.729    0.    1.600
20   135.0   135.0    0.    0.729    0.    2.400
21   135.0   135.0    0.    0.729    0.    3.200
22   135.0   135.0    0.    0.729    0.    4.800
23   135.0   135.0    0.    0.729    0.    8.000
24   135.0   135.0    0.    0.729    0.   12.000
25   135.0   135.0    0.    0.729    0.   16.000
26   135.0   135.0    0.    0.729    0.   24.000
27   135.0   135.0    0.    0.729    0.   40.000
28   135.0   135.0    0.    0.729    0.    0.
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C103

SURFACE NUMBER   2 ,   1 (SPECIFIED)

SURFACE DEFINED BY:	POINT	X	Y	F(x)
2- 2		525.00	166.00	1.00
5- 5		975.00	463.00	1.00
6- 6		1250.00	488.00	1.00
7- 7		1285.00	469.50	1.00

INS,IT   1 -1
INS,IT   1 0
INS,IT   1 2

X-COORD.	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
536.00	-210.	-210.	-84.	-5.45	-0.870	2.39	1.00	1.00	0.
553.79	-421.	-421.	-129.	-85.68	-4.857	2.39	1.00	1.00	0.
585.50	-1298.	-1298.	-397.	-286.77	-7.560	2.39	1.00	1.00	0.
639.00	12695.	12695.	3882.	248.54	3.464	2.39	1.00	1.00	0.
648.47	24233.	24233.	7410.	179.94	2.315	2.39	1.00	1.00	0.
650.00	26183.	26183.	8006.	174.78	2.221	2.39	1.00	1.00	0.
658.00	36777.	36777.	11245.	157.88	1.888	2.39	1.00	1.00	0.
678.00	65261.	65261.	19955.	145.06	1.594	2.39	1.00	1.00	0.
688.00	80384.	80384.	24579.	144.11	1.524	2.39	1.00	1.00	0.
695.00	91381.	91381.	27942.	144.47	1.471	2.39	1.00	1.00	0.
720.00	165092.	165092.	50480.	132.77	1.168	2.39	1.00	1.00	0.
734.50	212096.	212096.	64853.	132.96	1.115	2.39	1.00	1.00	0.
766.00	369753.	369753.	113059.	129.69	0.960	2.39	1.00	1.00	0.
774.50	415373.	415373.	127009.	130.62	0.949	2.39	1.00	1.00	0.
795.00	595706.	595706.	182149.	126.77	0.879	2.39	1.00	1.00	0.
816.00	789212.	789212.	241317.	127.26	0.842	2.39	1.00	1.00	0.
829.00	960168.	960168.	293599.	126.10	0.805	2.39	1.00	1.00	0.
833.00	1013871.	1013871.	310011.	126.06	0.800	2.39	1.00	1.00	0.
847.00	1204153.	1204153.	368194.	126.58	0.789	2.39	1.00	1.00	0.
850.00	1256416.	1256416.	384174.	126.34	0.787	2.39	1.00	1.00	0.
880.00	1798220.	1798220.	549842.	127.23	0.738	2.39	1.00	1.00	0.
890.00	2068243.	2068243.	632407.	126.66	0.716	2.39	1.00	1.00	0.
902.27	2403922.	2403922.	735047.	126.82	0.717	2.39	1.00	1.00	0.
905.00	2478496.	2478496.	757850.	126.93	0.718	2.39	1.00	1.00	0.
913.50	2712952.	2712952.	829539.	127.45	0.708	2.39	1.00	1.00	0.
930.00	3316466.	3316466.	1014076.	127.40	0.691	2.39	1.00	1.00	0.
933.00	3427813.	3427813.	1048122.	127.54	0.688	2.39	1.00	1.00	0.
947.00	3951742.	3951742.	1208324.	128.55	0.686	2.39	1.00	1.00	0.
955.00	4428771.	4428771.	1354185.	127.80	0.673	2.39	1.00	1.00	0.
975.00	5638663.	5638663.	1724134.	127.75	0.662	2.39	1.00	1.00	0.
981.50	5992218.	5992218.	1832241.	129.32	0.658	2.39	1.00	1.00	0.
996.00	7159385.	7159385.	2189125.	117.45	0.635	2.39	1.00	1.00	0.
1007.00	8024924.	8024924.	2453781.	112.52	0.618	2.39	1.00	1.00	0.
1014.00	8568955.	8568955.	2620129.	109.72	0.608	2.39	1.00	1.00	0.
1016.50	8761976.	8761976.	2679149.	108.77	0.605	2.39	1.00	1.00	0.
1035.00	11144434.	11144434.	3407654.	99.22	0.556	2.39	1.00	1.00	0.
1046.00	12591864.	12591864.	3837983.	94.86	0.535	2.39	1.00	1.00	0.
1072.00	18452385.	18452385.	5642186.	83.03	0.483	2.39	1.00	1.00	0.
1076.00	19341255.	19341255.	5913975.	81.64	0.480	2.39	1.00	1.00	0.
1095.50	25978418.	25978418.	7943421.	74.30	0.448	2.39	1.00	1.00	0.
1100.00	28022878.	28022878.	8568556.	72.68	0.442	2.39	1.00	1.00	0.
1112.50	33606157.	33606157.	10276366.	68.74	0.428	2.39	1.00	1.00	0.
1119.00	37964604.	37964604.	11608437.	66.59	0.420	2.39	1.00	1.00	0.
1125.00	41937232.	41937232.	12823147.	64.81	0.414	2.39	1.00	1.00	0.
1131.00	45918570.	45918570.	14040521.	63.23	0.397	2.39	1.00	1.00	0.
1137.50	53119654.	53119654.	16242396.	61.39	0.402	2.39	1.00	1.00	0.
1147.00	57929176.	57929176.	17713004.	60.12	0.406	2.39	1.00	1.00	0.
1153.00	69280371.	69280371.	21183859.	57.14	0.402	2.39	1.00	1.00	0.
1158.00	74288221.	74288221.	22715109.	55.86	0.400	2.39	1.00	1.00	0.

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1169.00   84849495, 84849495, 25944418,     53.08     0.406    2.39    1.00    1.00    0.
1175.00   90216783, 90216783, 27585986,     51.92     0.429    2.39    1.00    1.00    0.
1181.50   95639112, 95639112, 29243571,     49.78     0.438    2.39    1.00    1.00    0.
1183.00   96841008, 96841008, 29611075,     49.37     0.441    2.39    1.00    1.00    0.
1192.00  103703243,103703243, 31709341,     46.93     0.457    2.39    1.00    1.00    0.
1199.00  108579373,108579373, 33200315,     45.03     0.482    2.39    1.00    1.00    0.
1202.00  110465689,110465689, 33777094,     44.20     0.528    2.39    1.00    1.00    0.
1204.00  111584366,111584366, 34119157,     43.62     0.591    2.39    1.00    1.00    0.
1205.00  112091388,112091388, 34274164,     43.34     0.629    2.39    1.00    1.00    0.
1211.00  114931840,114931840, 35142709,     41.62     0.646    2.39    1.00    1.00    0.
1221.00  119172839,119172839, 36439479,     38.84     0.701    2.39    1.00    1.00    0.
1231.00  122752948,122752948, 37534047,     36.15     0.781    2.39    1.00    1.00    0.
1246.00  127166977,127166977, 38883847,     32.28     0.858    2.39    1.00    1.00    0.
1250.00  128023879,128023879, 39145800,     31.29     1.190    2.39    1.00    1.00    0.
1253.00  299931428,299931428, 91710032,     11.50     0.723    2.39    1.00    1.00    0.
1283.11  -1230711, -1230711,  -376314,      0.        0.       0.      1.00    1.00    0.
F =    0.727 LAMBDA =   0.306(  1   3   1)
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SOIL DATA

NO	WET	SAT	COH	FI	RU	EO
1	135.0	135.0	0.	0.729	0.	0.050
2	135.0	135.0	0.	0.729	0.	0.050
3	135.0	135.0	0.	0.729	0.	0.070
4	135.0	135.0	0.	0.729	0.	0.070
5	135.0	135.0	0.	0.729	0.	0.080
6	135.0	135.0	0.	0.729	0.	0.090
7	135.0	135.0	0.	0.729	0.	0.110
8	135.0	135.0	0.	0.729	0.	0.140
9	135.0	135.0	0.	0.729	0.	0.180
10	135.0	135.0	0.	0.729	0.	0.230
11	135.0	135.0	0.	0.729	0.	0.270
12	135.0	135.0	0.	0.729	0.	0.380
13	135.0	135.0	0.	0.729	0.	0.450
14	135.0	135.0	0.	0.729	0.	0.540
15	135.0	135.0	0.	0.729	0.	0.720
16	135.0	135.0	0.	0.729	0.	0.900
17	135.0	135.0	0.	0.729	0.	1.080
18	135.0	135.0	0.	0.729	0.	1.440
19	135.0	135.0	0.	0.729	0.	1.800
20	135.0	135.0	0.	0.729	0.	2.700
21	135.0	135.0	0.	0.729	0.	3.600
22	135.0	135.0	0.	0.729	0.	5.400
23	135.0	135.0	0.	0.729	0.	9.000
24	135.0	135.0	0.	0.729	0.	13.500
25	135.0	135.0	0.	0.729	0.	18.000
26	135.0	135.0	0.	0.729	0.	27.000
27	135.0	135.0	0.	0.729	0.	45.000
28	135.0	135.0	0.	0.729	0.	0.

SURFACE NUMBER   2 ;   1 (SPECIFIED)

SURFACE DEFINED BY#   POINT   X   Y   F(X)
                       2- 2   525,00   169,00   1,00
                       5- 5   975,00   483,00   1,00
                       6- 6   1250,00   488,00   1,00
                       7- 7   1285,00   469,50   1,00

INS,IT   1 -1
INS,IT   1   0
INS,IT   1   2

X-COORD,	E		X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
936,00	-207,	-207,	-59,	-6,38	-1,019	2,55	1,00	1,00	0,
553,79	-88,	-88,	-25,	-484,48	-27,464	2,55	1,00	1,00	0,
585,50	404,	404,	1167	1091,07	28,765	2,55	1,00	1,00	0,
639,00	18980,	18980,	5426,	191,82	2,674	2,55	1,00	1,00	0,
648,47	32658,	32658,	9336,	153,66	1,977	2,55	1,00	1,00	0,
650,00	34968,	34968,	9997,	150,56	1,913	2,55	1,00	1,00	0,
658,00	47927,	47927,	13587,	140,38	1,676	2,55	1,00	1,00	0,
678,00	81293,	81293,	23240,	133,65	1,469	2,55	1,00	1,00	0,
688,00	99220,	99220,	28365,	133,99	1,417	2,55	1,00	1,00	0,
695,00	112257,	112257,	32092,	134,97	1,374	2,55	1,00	1,00	0,
720,00	197842,	197842,	56559,	127,03	1,117	2,55	1,00	1,00	0,
734,50	252417,	252417,	72161,	128,08	1,074	2,55	1,00	1,00	0,
766,00	433879,	433879,	124038,	126,63	0,938	2,55	1,00	1,00	0,
774,50	486388,	486388,	139049,	127,81	0,928	2,55	1,00	1,00	0,
795,00	692330,	692330,	197923,	124,90	0,866	2,55	1,00	1,00	0,
816,00	913316,	913316,	261099,	125,94	0,834	2,55	1,00	1,00	0,
829,00	1107841,	1107841,	316710,	125,13	0,799	2,55	1,00	1,00	0,
833,00	1168948,	1168948,	334179,	125,18	0,795	2,55	1,00	1,00	0,
847,00	1385484,	1385484,	396077,	125,97	0,785	2,55	1,00	1,00	0,
850,00	1444807,	1444807,	413042,	125,79	0,784	2,55	1,00	1,00	0,
880,00	2060019,	2060019,	588919,	127,16	0,738	2,55	1,00	1,00	0,
890,00	2365916,	2365916,	676369,	126,74	0,716	2,55	1,00	1,00	0,
902,27	2746192,	2746192,	785082,	127,05	0,719	2,55	1,00	1,00	0,
905,00	2830673,	2830673,	809234,	127,19	0,719	2,55	1,00	1,00	0,
913,50	3096277,	3096277,	885105,	127,81	0,710	2,55	1,00	1,00	0,
930,00	3779113,	3779113,	1080374,	127,94	0,694	2,55	1,00	1,00	0,
933,00	3905094,	3905094,	1116390,	128,11	0,691	2,55	1,00	1,00	0,
947,00	4497884,	4497884,	1285857,	129,26	0,689	2,55	1,00	1,00	0,
955,00	5036780,	5036780,	1439916,	128,56	0,677	2,55	1,00	1,00	0,
975,00	6403585,	6403585,	1830659,	128,66	0,667	2,55	1,00	1,00	0,
981,50	6813643,	6813643,	1947886,	126,08	0,662	2,55	1,00	1,00	0,
996,00	8149101,	8149101,	2329668,	118,00	0,638	2,55	1,00	1,00	0,
1007,00	9139442,	9139442,	2612787,	113,09	0,621	2,55	1,00	1,00	0,
1014,00	9761916,	9761916,	2790740,	110,29	0,611	2,55	1,00	1,00	0,
1016,50	9982769,	9982769,	2853877,	109,34	0,608	2,55	1,00	1,00	0,
1035,00	12679389,	12679389,	3624788,	99,92	0,560	2,55	1,00	1,00	0,
1046,00	14272409,	14272409,	4080201,	95,64	0,539	2,55	1,00	1,00	0,
1072,00	20903020,	20903020,	5975762,	84,08	0,489	2,55	1,00	1,00	0,
1076,00	21901873,	21901873,	6261314,	82,73	0,486	2,55	1,00	1,00	0,
1095,50	29336322,	29336322,	8386676,	75,55	0,455	2,55	1,00	1,00	0,
1100,00	31622886,	31622886,	9040360,	73,96	0,450	2,55	1,00	1,00	0,
1112,50	37869572,	37869572,	10826165,	70,10	0,437	2,55	1,00	1,00	0,
1119,00	42734749,	42734749,	12217023,	67,98	0,429	2,55	1,00	1,00	0,
1125,00	47171286,	47171286,	13485342,	66,23	0,423	2,55	1,00	1,00	0,
1131,00	51617551,	51617551,	14756441,	64,68	0,406	2,55	1,00	1,00	0,
1137,50	59650389,	59650389,	17052871,	62,84	0,412	2,55	1,00	1,00	0,
1142,00	65015430,	65015430,	18586631,	61,57	0,416	2,55	1,00	1,00	0,
1153,00	77677734,	77677734,	22206534,	58,64	0,412	2,55	1,00	1,00	0,
1158,00	83264011,	83264011,	23803541,	57,39	0,411	2,55	1,00	1,00	0,

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1169.00   95045110,  95045110,  27171525,      54.68      0.419      2.55      1.00      1.00        0.
1175.00  101032385, 101032385,  28083169,      53.17      0.439      2.55      1.00      1.00        0.
1181.50  107081014, 107081014,  30612353,      51.48      0.453      2.55      1.00      1.00        0.
1183.00  108421734, 108421734,  30995638,      51.08      0.456      2.55      1.00      1.00        0.
1192.00  116076584, 116076584,  33184009,      48.73      0.474      2.55      1.00      1.00        0.
1199.00  121515926, 121515926,  34739010,      46.90      0.502      2.55      1.00      1.00        0.
1202.00  123620119, 123620119,  35340557,      46.10      0.551      2.55      1.00      1.00        0.
1204.00  124868009, 124868008,  35697304,      45.55      0.617      2.55      1.00      1.00        0.
1205.00  125433593, 125433593,  35856994,      45.27      0.657      2.55      1.00      1.00        0.
1211.00  128602352, 128602352,  36764879,      43.63      0.677      2.55      1.00      1.00        0.
1221.00  133334875, 133334875,  38117814,      40.98      0.740      2.55      1.00      1.00        0.
1231.00  137331396, 137331396,  39260341,      38.44      0.831      2.55      1.00      1.00        0.
1246.00  142261648, 142261648,  40669803,      34.79      0.924      2.55      1.00      1.00        0.
1250.00  143223352, 143223352,  40944735,      33.86      1.288      2.55      1.00      1.00        0.
1253.00  372129196, 372129196, 106384407,      11.27      0.708      0.        1.00      1.00        0.
1283.11    -405168,   -405168,   -115830,       0.        0.        0.        1.00      1.00        0.
F =     0.700 LAMBDA =     0.286(    7     9     1)
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————————— SOIL DATA —————————

NO   WET    SAT    COH     FI     RU      EQ
 1   135.0  135.0   0.    0.729   0.     0.050
 2   135.0  135.0   0.    0.729   0.     0.060
 3   135.0  135.0   0.    0.729   0.     0.070
 4   135.0  135.0   0.    0.729   0.     0.080
 5   135.0  135.0   0.    0.729   0.     0.090
 6   135.0  135.0   0.    0.729   0.     0.100
 7   135.0  135.0   0.    0.729   0.     0.130
 8   135.0  135.0   0.    0.729   0.     0.150
 9   135.0  135.0   0.    0.729   0.     0.200
10   135.0  135.0   0.    0.729   0.     0.250
11   135.0  135.0   0.    0.729   0.     0.300
12   135.0  135.0   0.    0.729   0.     0.400
13   135.0  135.0   0.    0.729   0.     0.500
14   135.0  135.0   0.    0.729   0.     0.600
15   135.0  135.0   0.    0.729   0.     0.800
16   135.0  135.0   0.    0.729   0.     1.000
17   135.0  135.0   0.    0.729   0.     1.200
18   135.0  135.0   0.    0.729   0.     1.600
19   135.0  135.0   0.    0.729   0.     2.000
20   135.0  135.0   0.    0.729   0.     3.000
21   135.0  135.0   0.    0.729   0.     4.000
22   135.0  135.0   0.    0.729   0.     6.000
23   135.0  135.0   0.    0.729   0.    10.000
24   135.0  135.0   0.    0.729   0.    15.000
25   135.0  135.0   0.    0.729   0.    20.000
26   135.0  135.0   0.    0.729   0.    30.000
27   135.0  135.0   0.    0.729   0.  5000.000
28   135.0  135.0   0.    0.729   0.     0.
```

C107

SURFACE NUMBER   2 ,   1 (SPECIFIED)

SURFACE DEFINED BY#   POINT   X   Y   F(X)
                          2- 2   525.00   166.00   1.00
                          5- 5   975.00   463.00   1.00
                          6- 6   1250.00   488.00   1.00
                          7- 7   1285.00   469.50   1.00

INS.IY   1 -1
NOT CONVERGING   0   1

X-COORD.		e	X-FORCE	Y-YT	Y-YT/Y-Z	VERT F	SMALL F		PORE PRES
536.00	1337,	1337,	401.	1.31	0.209	2.43	1.00	1.00	0.
553.79	11869,	11869,	3961.	8.79	0.385	2.43	1.00	1.00	0.
585.50	55525,	55525,	16658.	15.57	0.410	2.43	1.00	1.00	0.
639.00	219926,	219926,	65978.	30.54	0.426	2.43	1.00	1.00	0.
648.47	268790,	268790,	80637.	33.40	0.430	2.43	1.00	1.00	0.
650.00	277044,	277044,	83113.	33.84	0.430	2.43	1.00	1.00	0.
658.00	321909,	321909,	96573.	36.23	0.432	2.43	1.00	1.00	0.
678.00	442541,	442541,	132762.	41.88	0.460	2.43	1.00	1.00	0.
688.00	506584,	506584,	151975.	44.54	0.471	2.43	1.00	1.00	0.
699.00	553159,	553159,	165948.	46.37	0.472	2.43	1.00	1.00	0.
720.00	770395,	770395,	231119.	53.31	0.469	2.43	1.00	1.00	0.
734.50	908921,	908921,	272676.	57.31	0.481	2.43	1.00	1.00	0.
766.00	1289472,	1289472,	386842.	66.05	0.489	2.43	1.00	1.00	0.
774.50	1399589,	1399589,	419877.	68.37	0.497	2.43	1.00	1.00	0.
795.00	1749115,	1749115,	524734.	73.92	0.513	2.43	1.00	1.00	0.
816.00	2124174,	2124174,	637252.	79.39	0.526	2.43	1.00	1.00	0.
829.00	2418088,	2418088,	725426.	82.73	0.528	2.43	1.00	1.00	0.
833.00	2510416,	2510416,	753125.	83.75	0.532	2.43	1.00	1.00	0.
847.00	2837557,	2837557,	851267.	87.26	0.544	2.43	1.00	1.00	0.
850.00	2920827,	2920827,	876248.	87.98	0.548	2.43	1.00	1.00	0.
880.00	3784088,	3784088,	1135226.	95.25	0.553	2.43	1.00	1.00	0.
890.00	4176727,	4176727,	1253018.	97.61	0.552	2.43	1.00	1.00	0.
902.27	4664839,	4664839,	1399452.	100.47	0.568	2.43	1.00	1.00	0.
905.00	4773277,	4773277,	1431983.	101.09	0.572	2.43	1.00	1.00	0.
913.50	5114198,	5114198,	1534259.	103.02	0.573	2.43	1.00	1.00	0.
930.00	5946351,	5946351,	1783905.	106.56	0.578	2.43	1.00	1.00	0.
933.00	6099881,	6099881,	1829964.	107.21	0.579	2.43	1.00	1.00	0.
947.00	6822298,	6822298,	2046689.	110.26	0.588	2.43	1.00	1.00	0.
955.00	7436134,	7436134,	2230840.	111.67	0.588	2.43	1.00	1.00	0.
975.00	8993010,	8993010,	2697903.	115.41	0.598	2.43	1.00	1.00	0.
981.50	9490722,	9490722,	2847217.	113.14	0.594	2.43	1.00	1.00	0.
996.00	10992206,	10992206,	3297602.	107.41	0.581	2.43	1.00	1.00	0.
1007.00	12105666,	12105666,	3631700.	103.60	0.569	2.43	1.00	1.00	0.
1014.00	12805526,	12805526,	3841658.	101.37	0.562	2.43	1.00	1.00	0.
1016.00	13053835,	13053835,	3916150.	100.60	0.560	2.43	1.00	1.00	0.
1035.00	15890734,	15890734,	4767220.	94.24	0.528	2.43	1.00	1.00	0.
1046.00	17566624,	17566624,	5269987.	91.09	0.513	2.43	1.00	1.00	0.
1072.00	24220084,	24220084,	7266025.	83.48	0.486	2.43	1.00	1.00	0.
1076.00	25222380,	25222380,	7566714.	82.47	0.485	2.43	1.00	1.00	0.
1095.50	32920507,	32920507,	9756152.	77.49	0.467	2.43	1.00	1.00	0.
1100.00	34741504,	34741504,	10422451.	76.40	0.465	2.43	1.00	1.00	0.
1112.50	40809063,	40809063,	12242719.	73.53	0.458	2.43	1.00	1.00	0.
1119.00	45486098,	45486098,	13645829.	72.04	0.455	2.43	1.00	1.00	0.
1125.00	49751071,	49751071,	14925321.	70.73	0.452	2.43	1.00	1.00	0.
1131.00	54025394,	54025394,	16207618.	69.53	0.437	2.43	1.00	1.00	0.
1137.50	82579852.0	82579852.0	247739556.	68.42	0.448	2.43	1.00	1.00	0.
1142.00	34125708.5	34125708.5	402377128.	66.99	0.452	2.43	1.00	1.00	0.
1153.00	557816704.	557816704.	767345016.	64.00	0.450	2.43	1.00	1.00	0.
1158.00	094530976.	094530976.	928359296.	62.78	0.450	2.43	1.00	1.00	0.
1169.00	226426880.	226426880.	267928064.	60.02	0.459	2.43	1.00	1.00	0.
1175.00	801667968.	801667968.	440500400.	58.34	0.481	2.43	1.00	1.00	0.
1181.50	382803840.	382803840.	614841192.	56.37	0.496	2.43	1.00	1.00	0.
1183.00	511616576.	511616576.	653484976.	55.91	0.500	2.43	1.00	1.00	0.
1192.00	247073728.	247073728.	874122128.	53.16	0.517	2.43	1.00	1.00	0.
1199.00	769670912.	769670912.	030901280.	51.01	0.546	2.43	1.00	1.00	0.
1202.00	971836032.	971836032.	091590816.	50.05	0.598	2.43	1.00	1.00	0.
1204.00	091729856.	091729856.	127518960.	49.38	0.669	2.43	1.00	1.00	0.
1205.00	146069696.	146069696.	143820912.	49.03	0.712	2.43	1.00	1.00	0.
1211.00	450717696.	450717696.	235215328.	47.01	0.729	2.43	1.00	1.00	0.
1221.00	906885888.	906885888.	372065760.	43.80	0.791	2.43	1.00	1.00	0.
1231.30	293821696.	293821696.	488146528.	40.77	0.881	2.43	1.00	1.00	0.
1246.00	772983040.	772983040.	631894912.	36.51	0.970	2.43	1.00	1.00	0.
1250.50	870291968.	870291968.	661087584.	35.43	1.348	2.43	1.00	1.00	0.
1253.00	942598912.	942598912.	682179880.	32.72	2.096	2.43	1.00	1.00	0.
1283.11	942282752.	942282752.	682684832.	0.	0.	0.	1.00	1.00	0.

F = 1.700   LAMDA =   0.300(0 20   0)
STOP AT LINE   L 5.....

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